THE IRON TRADE REVIEW

VOLUME XXVI. CLEVELAND, O. MARCH 9, 1893. CHICAGO, ILL. NUMBER 10.

MAGNOLIA METAL

IN USE BY

Eight Leading Governments.

BEST ANTI-FRICTION METAL FOR

High-speed Engine, Dynamo, Rolling-Mill, Steamship, Railroad, Saw-Mill, Cotton-Mill, Paper-Mill, Woolen-Mill, Silk-Mill, Jute-Mill, Rubber-Mill, Sugar-Mill, Flour-Mill, and all Machinery Bearings.

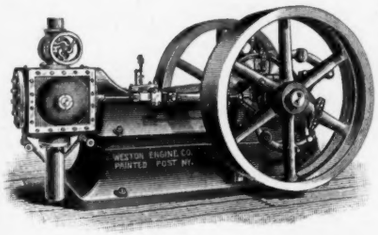
MAGNOLIA ANTI-FRICTION METAL CO.,

Owners and Sole Manufacturers,

London Office, 75 Queen Victoria St.
Chicago Office, 41 Traders Building.

74 Cortlandt Street, NEW YORK.

WESTON ENGINES.



High Pressure Boilers.
Complete Power Plant.
Estimates and Drawings Submitted.

WESTON ENGINE CO.,
PAINTED POST, N. Y.

REPRESENTATIVES:
JULIAN SCHOLL & CO., 126 LIBERTY ST., NEW YORK, N. Y.
GEO. D. HOFFMAN, 82 LAKE ST., CHICAGO, ILL.
H. M. SCIPLE & CO., 3rd and Arch Sts., PHILADELPHIA, PA.

WALSTON—**COKE**—CONNELLSVILE.

F. J. & H. R. POOL, Western Reserve Building, CLEVELAND, OHIO.

THE S. OBERMAYER CO.,

CINCINNATI, - OHIO,
MANUFACTURERS OF
FOUNDRY FACINGS, FOUNDRY SUPPLIES, FOUNDRY EQUIPMENTS,
Shippers of Moulding Sands and Fire Brick.
WRITE FOR CATALOGUE.

PRESSED WROUGHT IRON OPEN TURN BUCKLES.

BEST AND CHEAPEST.

The list retail price of this Buckle is less than one-half the wholesale price of inferior goods when we commenced to manufacture, and dealers, even in small towns, find it profitable to carry a stock to sell with iron for tie rods.

CLEVELAND CITY FORGE & IRON CO., Cleveland, Ohio.

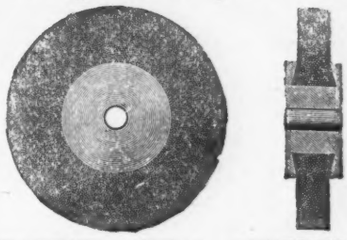
- - J. C. SLOCUM, D. E. - -

CONSULTING ENGINEER,

ECONOMICAL AND SMOKELESS COMBUSTION, EXAMINATIONS, TESTS, REPORTS, ESTIMATES AND SUPERINTENDENCE.

235 La Salle St., Grand Pacific, - - - - CHICAGO, ILL.

THE ACME
Safety Emery Wheel



PATENT METAL CENTRED
EMERY AND CORUNDUM WHEEL.
10 to 36 Inch Diameter.
We also make

Solid Emery & Corundum Wheels.

THE "SAFETY" FEATURE of this wheel is shown in the sectional cut, the material being dovetailed into the metal, insuring immunity from danger in case of Wheel bursting. We have run a split wheel 2,800 revolutions per minute, the metallic centre retaining the material in place..

Water Wheels, Cup Wheels and Special Shapes to Order.

SPECIAL ATTENTION TO SAW GUMMERS.
Discount on all Centers Returned for Refilling This means Economy. Descriptive Circulars, Price Lists and Catalogues Mailed on Application.

THE
Acme Safety Emery Wheel Co.,
Foot of Leib Street,
DETROIT, MICH.

Stowe, Fuller & Co.,

DOVER, QUEEN'S RUN, STANDARD, SAVAGE AND WALLACE,
MANUFACTURERS AND SHIPPERS
FIRE BRICK, FIRE CLAY.
171 Merwin Street,
CLEVELAND, OHIO.

SHARON FIRE BRICK WORKS,

SHARON, PA.

No. 1 Silica Brick. No. 1 Mill Brick.

SILICA BRICK, FOR ROLLING MILLS AND STEEL SMELTING FURNACES, FIRE CLAY.

SHARON PA

William B. Pollock & Co.,

Youngstown, Ohio.

Manufacturers of

Steam Boilers—Every Type.

Sheet and Plate Work.

Penstocks; Cupolas; Gas-Producers;
Hacles; Blast Furnaces. Converters;
Oil and Water Tanks; Tanks; Receivers;
Buildings; Smelters Large Draught Stacks;

Riveted Pipe for Water, Gas, Air or Steam;

Plate Construction.— All Kinds.

STILWELL'S

PATENT LIME-EXTRACTING

Heater and Filter

COMBINED,

Is the only lime-extracting Heater that will prevent scale in steam boilers, removing all impurities from the water before it enters the boiler. Thoroughly tested.

OVER 3,000 OF THEM IN DAILY USE.

This cut is the fac-simile of the appearance of the shelves of a No. 5 Heater at work on ordinary lime water when the door was removed after the Heater had been running two weeks.

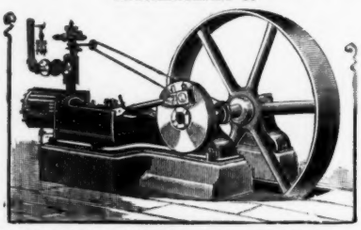
ILLUSTRATED CATALOGUES.

Stilwell & Bierce Mfg. Co.,

DAYTON, OHIO.

L. SPENCE & SON,

Manufacturers of



STATIONARY ENGINES, 20 TO 100 H. P.

Portable Engines,

THRESHING MACHINES,

—AND—

Large Engines for Rolling Mills and Blast Furnaces.

Send for illustrated catalogue.

Martin's Ferry, Ohio.

THE KILBOURNE & JACOBS MFG. CO., Columbus, Ohio, U. S. A.

Largest manufacturers in the United States of Wood and Steel Wheelbarrows, Charging Barrows, Dump Carts, etc. Goods guaranteed superior to any others upon the market. Prices moderate. Write us for catalogue and prices before purchasing elsewhere.

Rainey - -

Connellsville

Furnace and Foundry

- - Coke.

The only Coke you can buy and know you are getting the best that can be manufactured. All our works in the heart of the Region, within four miles of Connellsville, Pa.

CAPACITY, 3,000 TONS DAILY.

W. J. Rainey, Cleveland, Ohio.

MAIN OFFICE:

MERCANTILE BANK BUILDING.

The Iron Trade Review

Pays special attention to iron ore, blast furnace, rolling mill, foundry and machine shop interests. Per year **$3.00.**

GAS and GASOLINE ENGINES.

STATIONARY and PORTABLE, All Sizes.

Dwarfs in Size, but Giants in Strength.

Expense one cent an hour per horse power and requires but little attention to run them. **Every Engine Guaranteed.** Full particulars free by mail Mention this paper.

VAN DUZEN GAS & GASOLINE ENGINE CO. Cincinnati, O.

TAYLOR BEST Yorkshire Bar Iron.

The best material for Stay Bolts, Piston Rods, Crank Pins, Etc.

Used by leading railroads.

Sole Representatives in the U. S., **B. M. JONES & CO.**

BOSTON: Nos. 11 and 13 Oliver Street. NEW YORK: No. 143 Liberty Street.

U. S. INJECTORS

GUARANTEED SUPERIOR to any other automatic injector ever before offered in any market in the world. Works with lower steam pressure than any other; works with higher steam pressure than any other. Handles warmer water than any other. Is more perfectly automatic. No higher price. Sold only through dealers, who may address Mfrs. of U. S. Injector, care of this paper.

THE IRON TRADE REVIEW

VOLUME XXVI. CLEVELAND, O. MARCH 9, 1893. CHICAGO, ILL. NUMBER 10.

THE WEEK IN IRON CIRCLES.

GENERAL FEATURES.

The word comes up from nearly every department of the iron trade, particularly from finished lines, that demand exceeds that of a year ago, and the volume of current business is large, but prices are very unsatisfactory. Mill men tell of a heavy output, heavier with some establishments than they have ever known, but with margins never so small. And this, too, with economies of production better studied than ever. Yet every new crosscut that saves cost goes to the advantage of the buyer. The producer finds it more difficult than ever to operate and make money. The apparent anomaly of larger demand and output and falling prices is only to be explained by an over-rapid increase of productive capacity. The finished iron and steel trades are troubled to day in the same way that the blast furnaces suffered one year ago. There has come, in the year, a better equilibrium between pig iron consumption and pig iron production. Southern primary markets send reports of lower prices, and one large transaction is reported that included gray forge on a basis of $8, Birmingham. This is not the market, however, and it may be said, on the other hand, that offers of $8, Birmingham, for gray forge have been declined in the week. There is no prospect of an early betterment in raw iron prices. The Thomas Iron Co. is making contracts in the Eastern market, with deliveries running through the year, at $15, $14 and $13 for the three grades, this being the basis on which business was taken by this company in the latter part of '92. There are nowhere any reliable reports of prices below those of last summer, though buyers have been industriously hammering the market. Furnacemen feel that they could not go below that notch and live, and even on the basis of the past month's prices only the favorably located furnaces can stay in blast. In some Northern markets the reductions in freights from the West and Southwest, coupled with a return to last fall's prices, have opened the way for an increased sale of Southern iron. In Eastern markets, however, little Alabama iron has been disposed of, in the last few weeks. The situation in finished iron and steel, as indicated above, shows no improvement. Mills are fairly provided with orders, some of them busy beyond their wont, but there is still not enough to go around. A brisk demand for rails would work an improvement in general mill price lists, but there is no prospect of that.

THE CLEVELAND OUTLOOK.

The discussion of prices for '93 ore has opened between one large buyer and certain sellers of Bessemer ores, but another month may come before any announcement of ore sales can be made. The talk of cheap ores has gone to a point at which an element of the ridiculous has mingled with the sober business aspects of the case. Norrie ore at the price attached to it in connection with the freely quoted remark of a Pittsburg buyer, would be a sheer donation, and there is no occasion for the serious import that has been given to talk of this sort by the Lake Superior press. The consensus of Cleveland ore salesmen's views, as gathered within the week, is that a point will be reached at which the mining interest will make a stand for a living profit; that Bessemer deposits are not to be exhausted without a fair return to their operators; that the necessity does not exist, at least this year, for such reductions as buyers talk of, since the demand for Bessemer ores is likely to be fully up to the amount that will be mined. There are signs in the mining region that there will be no assistance given to the downward movement of prices by the piling of large stocks on the market. The curtailment of working force at the Norrie is in pursuance of the policy of the management to let demand fix the gauge of operations. Sales of Bessemers from the docks in the past two weeks have been at prices ranging from $4 to $4.15 for soft ores, of which only odd lots are available. Hard Bessemers have been held at $5 to $5.25 for low phosphorus speculars, but figures on recent transactions are covered. The movement of ore to furnaces has been at about the pace of last winter, probably somewhat in excess. The chances are that the ore on the docks May 1, will exceed the 1,537,188 tons of May 1, 1892. As a contribution to the discussion of vessel rates at the opening, attention is directed to the probabilities of a high stage of water at the Sault, as there are now fully five feet of snow on all the region tributary to Lake Superior, and the fall has been three times that of last winter.

Pig Iron.

There is no gain in strength in the local market for raw iron. In foundry iron prices have weakened. While No. 1 was held at $14.35 ten days ago, sales are known to have been made on the basis of $14, Cleveland, the lowest price yet quoted. There was a change from Bessemer to foundry iron, in the operation of several valley furnaces, in the slump in Bessemer a few weeks ago, and the market for foundry shows more pressure to sell. Seven furnaces in the two valleys are now running on Bessemer, most of them having contracts which they are executing. There is not a great amount of Bessemer on the market, but prices are not strong, $13.50, Cleveland, being current and this is shaded in Pittsburg.

Finished Iron, etc.

The demand upon mills and upon jobbing houses is steady, but complaint of low prices does not abate. Inquiry is distributed among all lines of mill products. The structural market is active, but in the face of good demand manufacturers seem afraid to let anything get away, even though they have to go below what they have regarded as bottom. The building outlook is good locally and in the district tributary to Cleveland. Our quotations on page 27 are unchanged.

THE CHICAGO OUTLOOK.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Business in the past week has been rather quiet in nearly all branches, but dealers generally feel that the month of March will close with a very satisfactory balance of trade to its credit. On nearly all grades of iron, both raw and manufactured, prices have stiffened a little, though not sufficiently so to make any change in quotations. The demand for architectural shapes is quite brisk, and with the advancing season it will probably increase rapidly. The foundries are all fairly busy, and have only light stocks on hand, so the chances for a good demand for pig iron are very bright. Altogether the outlook is encouraging for the coming several weeks.

PIG IRON.—Quite a good business has been done in the past few days, several orders of good size being reported. The Tennessee Coal, Iron & R. R. Co. are reported as being out of the market on soft irons, as they are stocked with orders. The larger business of the week was done in Southern coke, but Northern irons have sold well, and a little business was closed in Lake Superior charcoal. Prices are, on the whole, quite satisfactory. Buyers seem to be pret y well satisfied that rock-bottom has been reached, and are coming into the market to purchase.

BAR IRON.—Several quite large sales have been made of bar iron recently, and while one or two of them with very favorable specifications were made at a little under quotations, the market is firm at 1.45c at the mills. Soft steel bars have had a good sale and are quoted at 1.65 to 1.70c, Chicago.

BILLETS AND RODS.—The market in the past week has been rather quiet, sales being made only to complete contracts. Billets, $25; rods, $32.50.

RAILS AND TRACK SUPPLIES.—A quite brisk inquiry has developed in the past few days, several deals that have been in statu quo for a long time having come to the surface. It is probable that a good deal of business will be closed in the next month. Quotations are unchanged at $30 to $32 for rails; track bolts, 2.65c to 2.70c; spikes, 2.05c to 2.10c.

STRUCTURAL IRON.—While no vast amount of business has been closed in the past week, the feeling of hopefulness noted in our last report still prevails, and small orders have come in with satisfactory frequency. Quotations are: beams and channels, 1.90c to 2.10c; universal plates, 1.95c to 2.15c; sheared plates, 1.95c to 2.10c; angles, 1.95c to 2 10c; tees, 2.25c to 2.40c.

SHEETS.—A good trade is being done in black sheets, the price still being 2.85c for No. 27. Galvanized iron sales have improved with the improvement in the weather, and the demand now is very brisk, both from store and for mill orders. Prices are unchanged at 70 and 7½ per cent. at the mills, and 65 and 10 per cent. to 70 per cent. from store.

PLATES, TUBES, ETC.—Business is jogging along at a quiet rate, and orders are being received every day, which show the demand to be on the increase. Quotations are —tank plates, 1.90c to 2.10c; shell steel, 2.20c to 2.30c; fire box steel, 3.75c to 4c; flange steel, 2.50c to 2.60c; tubes, discount of 62½ per cent.

MERCHANT STEEL.—A fair business is being done with prices unchanged. Open-hearth spring, 2.35c to 2.40; tire, 2c to 2.15c; machinery, 2.20c to 2.25c; crucible spring, 3.60c; machinery, 4.75c; tool steel, 6½c and upwards; Bessemer bars, 1.80c to 1.90c.

OLD RAILS, SCRAP, ETC.—Dealers are buying largely on speculation, but are doing little selling. Quotations are made— old rails $18; old wheels, $14.50 to $14.75; old steel rails, $11 to $14.50; No. 1 forge, $15; No. 1 mill, $11; turnings, $8; mixed steel, $9; coil steel, $13; leaf steel, $14; low tires, $13.00.

GENERAL MARKET RESUME.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Pittsburg. A fair inquiry is kept up for standard brands of pig iron, but transactions have not been large. Buyers show a conservative spirit and are not contracting far ahead. Leading makes of pig iron are commanding prices close to quotations, but there are furnacemen ready to offer concessions to stimulate buying. There is thus an irregularity about the market that makes it difficult to gauge it accurately. It has ga ned nothing in firmness, however. Bessemer transactions have been at $13 40 and $13.50, with deliveries 60 days ahead, and smaller lots have sold higher. Foundry and mill irons have both been in fair demand, the former moving more freely than for some time, indicating a good supply of foundry contracts in this district. Makers of billets are quite well sold up for the next month or two, and transactions show an advance above $22, which was the top of the market two weeks ago. A few lots have been bought at from $22.10 to $22.25, with sellers holding firmly for the advance. Scrap has been more active and a good deal has moved in the week at market price. Old iron and steel rails are not as plentiful.

Cincinnati. The past week has been very quiet in the pig iron market. While many are endeavoring to secure lower figures for shipments covering five or six months, especially on grey forge, most of such buyers meet with disappointment, as many of the furnaces, if not the majority, in the South are well supplied with orders for grey forge and mottled, covering four and five months' deliveries, and at better than the prices of to-day. There has been no special demand for foundry grades, the majority of buyers contemplating still lower prices in 30 to 60 days. Sellers maintain that there is no reason why such a thinking should exist, as the consumption is well up with the production. An important event of the past 10 days was the making of the first pig iron by the Watts Iron & Steel Syndicate, of Middlesborough, Ky. This important English improvement has been held back by the embarrassment of J. P. Witherow, who had the contracts for construction. The first furnace was blown in, and the second follows this week. Local coke, known as Mingo Mt., is being successfully used as well as Pocahontas coke.

Louisville. A number of sales have been made, but at low prices. The market is quite demoralized and transaction have been as low as $8 for gray forge. Furnaces selling make a strong point of making deliveries as short as possible, but transactions have been closed running well into the year, and in some instances throughout the year, on the above basis. Purchase shave been quite large, and in one instance nearly 12,000 tons were placed. Buyers are trying to purchase into 1894, and reports, especially from the Chicago district, show that furnaces there are quoting for several months beyond 1893.

Detroit. A large inquiry was seen during the past week for coke iron, mostly for Northern grades. Transactions, including one large one, aggregated a considerable tonnage. The market continues to be a buyers' one. Several large deals were consummated for Lake Superior charcoal pig. One buyer closed for 4,000 tons, delivered over the next three months. There is a disposition among Lake Superior furnacemen to take advantage of the present short supply, and refuse to sell for such delivery except at an advance.

THE IRON TRADE REVIEW

DEVOTED TO
IRON ORE, IRON AND STEEL MANUFACTURE, MACHINERY
TRANSPORTATION, INDUSTRIAL PROGRESS,
STATISTICAL INFORMATION, ETC.
PUBLISHED EVERY THURSDAY BY
THE IRON TRADE REVIEW CO.,
CLEVELAND, OHIO.

CLEVELAND: 27 VINCENT STREET. | CHICAGO: 1419 MONADNOCK BLOCK.

TERMS OF SUBSCRIPTION, (strictly in advance):

One year.....$3 00
Six months.....1 50
Three months.....75

Advertising Rates Furnished on Application.

ENTERED AT THE POST OFFICE IN CLEVELAND, O., AS SECOND CLASS MATTER.

MARCH 9, 1893.

TAKING FUEL TO THE ORE.

It is not a new proposition that Mr. Richard A. Parker, of Marquette, brings before our readers in other columns of this issue. But we doubt if there has been a more thorough-going treatment, in its various phases, of the question of taking fuel to the ores of the Lake Superior region than is contained in this communication. We look for it to have a very careful reading.

In brief, the position that Mr. Parker takes is that Connellsville coal can be transported to the shores of Lake Superior, to Marquette, for example, successfully coked there and used in the smelting of ores near at hand, and that the pig iron thus made will be produced at a cost considerably below the possible cost at Chicago, thus giving an upper lake furnace that much advantage in markets equidistant from Chicago and Marquette, for example, and an advantage, though less, at other points more remote from Marquette than from Chicago. In a word, he believes that the making of coke iron in the Lake Superior region offers returns amply justifying investments in blast furnaces at Marquette, and probably other points.

We believe that the estimates given for Marquette, in lieu of anything experimental there, are as fair and as conservative as could be asked. They are doubtless as nearly correct as they could be made, apart from actual operation. Some of them, as Mr. Parker suggests, might be lowered in practice. Mr. Parker's familiarity with the ores of that region and his knowledge of current prices, make the calculation on that score as close an approach to exactness as advance figures could come.

The net result of the estimates and comparisons is a saving of $1.45 at Marquette over the cost of making coke iron at Chicago.

What is said about the possibilities of using low grade ores and their special cheapness close to the mines, is worth a word of comment. The economical furnace practice at the head of the lakes, as elsewhere, we believe would be that which dealt with high grade ores. Unless the mines made an exceedingly tempting figure on low grades, it is a question whether their use in the furnace would be the best economy. Experience has shown a large balance on the side of high grade ores, in the increased furnace capacity secured with the same managing expenses and the same cost of handling raw material, the decreased cost for handling slag per ton, the lessening of damage to furnace lining, and the better control of product secured.

The article presents an inviting prospect, and that with no fictitious basis as to figures. If there has been any miscalculation, our columns are open to the fullest discussion. Certainly the Northwest will not long be dependent upon the Chicago and the Milwaukee districts for its coke pig iron and its mill products. With ores on the ground their cheapness is an immense advantage. Now let the coke problem be satisfactorily solved, with a proper showing of economy, and the way is open. Mr. Parker has done good service in gathering together with such painstaking and discrimination the facts in this line that are most to the purpose. We turn, now, to look for furnacemen of brains and energy and money, who are needed to do the rest.

PIG TIN STAYS ON THE FREE LIST.

Neither Temescal nor Harney Peak has as yet fulfilled the fair promises made for the native tin industry. These are the only properties that justified any expectations for that industry, and the abandonment of operations at both was tantamount to an abandonment of tin mining in the United States. While all that was said of Temescal was justified by actual output, the deposit, it appears, was not extensive enough to warrant the cost of production. Concerning Harney Peak there has been a variance of statement from the start; but the suspension of work at a time when every effort would naturally be put forth, if the tin were there, in order to prevent any disturbance of the proviso for the 4-cent duty beg nning July 1 next, would indicate that the operating company has little confidence that a money-making scale of operations could be maintained.

The bill to prevent the taking effect of the McKinley tariff on block tin passed the 52d Congress in its closing hours and that commodity will continue on the free list. As far as discovery has gone thus far, it appears that nature did not endow the United States with tin deposits sufficient for the needs of the country. It is to be hoped that expectations in this direction may yet be realized, and that those who have taken special delight in minimizing the tin mining industry and in predicting its failure may one day see the defeat of their unpatriotic desire. The cancellation of the prospective duty on pig tin was proper legislation. The free raw material idea is one with which protectionists can readily fall in when there is no native industry to protect; and with no native producers of block tin to compete with, the foreign seller would not be likely to assume the smallest fraction of any duty that might be imposed—it would all be added to the foreign price and be that much of a burden to the American tin plate industry.

Home tin plate manufacture, by the way, has made great strides in the first half of its second year, and even with the Damocles sword over its head, is putting out extensions and planning for perma· ency. It has made such a demonstration of vitality—as the report printed in these columns last week gives full proof—that it is a question whether the majority in Congress will want to take the responsibility of legislation that would cripple it. Consumers prefer tin plate made from black plates rolled in the United States from the best Bessemer steel and are paying scarcely more than half the duty over and above the price paid before the McKinley bill went into effect.

FROM crushing only the ore, blast furnace managers have extended the preparation of materials for the furnace

until it is now the practice to crush the limestone as well, and a Pittsburg firm are now putting in crushers that will break up not only ore and limestone, but cinder. It is found that uniformity in the size of material composing the burden facilitates smelting and tends to evenness and uniformity in the work of the furnace. Spaces are thus maintained, and of the same size, permitting the reducing gases to come in close contact with the materials, making the reduction of the ore even-paced throughout the burden.

FOR FOUNDRYMEN.

The proposition to form a Western Foundrymen's Association is favorably spoken of in several letters that have reached this office in the past week. The feeling grows that the vast interest represented in the melting and moulding of iron, in the Central West, can be furthered by an organization that may in time become a positive force in staying ruinous competition. The social feature, the interchange of views on methods, and the gathering and distributing of information about the foundry interest, are chief among the benefits anticipated from an association that shall meet two or three times a year or oftener; but the ultimate aim of all effort in this line is such a mutual understanding of conditions and such a consensus on administrative questions, particularly on the folly of disposing of product without a profit, that there may be some check on the demoralization that has come from bad figuring and throat-cutting competition.

Recognizing that a Western Foundrymen's Association, such as has been proposed in these columns, could be of great service, one prominent Chicago foundry proprietor writes: "I think the idea suggested an excellent one and shall be pleased to attend any meeting that may be called for the organization of such an association." Another writes: "We see no reason why one of us could not become a member of such an association. We should be very glad to give any assistance in our power." A third large Western concern, after stating that it has membership in the Philadelphia Foundrymen's Association, says: "If an association is established in this neighborhood we shall in all probability become members. We consider the methods of the Philadelphia association quite valuable to us." The secretary of a Michigan concern writes that he would want to join such an association if there were just ten others ready to go in at the start. A gentleman who is at the head of an extensive foundry interest says: "The scheme in view for the organization of the founders of the United States is a good one and well worthy the careful consideration of all pipe and machine founders and institutions of that class."

As illustrating the changing conditions in the foundry interest and the expansion of the jobbing foundry as a factor in the business, a gentleman notes in connection with a recent visit to Cincinati, that the large users of castings, the Egan Co., the J. A. Fay Co. (the two concerns recently consolidated), the Lodge & Davis Machine Tool Co., and other large builders of machinery, do not operate their own foundries, but buy all their castings. It thus comes about that the manufacturer of machines and machine tools is able to make a clean profit on his specialty, while the foundryman who furnishes castings under contract, owing to the demoralization which has come from unwise competition, does business on slender margins and often with none.

There is a growing belief among Western foundrymen that closer personal relations and the substitution of frank discussion for distrust and secretiveness may help to change their status for the better. Our columns are open for the fullest expression on the subject. The more talk, the more light.

AMONG THE IRON MINES.

As an evidence that surface stripping and open pit mining will be successful on the Mesabi, is the contract made by the Biwabik Ore Co., with Drake, Stratton & Co., of Pittsburg and New York. The contract calls for the removal of 200,000 cubic yards of earth. This work is to be done on the east end of the Biwabik mine, while the Biwabik Co. is progressing with its shipping on the West end. The stripping on the east end is to be ready for taking out ore by the 25th of May, and to keep ahead of two steam shovels thereafter. Four locomotives, two steam shovels and all the supplies necessary for this work, are already on their way to the mine. Work is to be carried on night and day by the aid of the electric light plant now under way. At the Berringer, as has been intimated in this column, the surface is to be stripped and then mining carried on underground, by milling the ore down and hoisting it through a shaft to the surface, where it can be loaded on cars. This unusual process will attract the attention of all miners. With the Canton, Berringer and Biwabik, all working by different methods, under practically the same conditions.

A test pit was sunk at the Biwabik, recently, a short distance to the north and west of the main cut. One sample of the ore assayed 67.20 in iron and .013 phosphorus; another went 65.50 in iron and .014 in phosphorus.

Articles of incorporation have been filed at Duluth by David T. Adams, P. L. Kimberley and Jno. T. Jones, for the Adams Mining Co., capital, $300,000.

The contract has been let to D. W. and Samuel Grant for the addition of 1,000 feet to the ore docks of the Duluth & Winnipeg at Allouez Bay. It is expected that 226 pockets, each with a capacity of 180 tons, will be ready when navigation opens. The present docks are 600 feet long.

S. F. Snively, president of the Snively Mining Co., and W. C. Sargent, one of the stockholders, have been inspecting the Snively mine, which is on the northeast quarter of section 3, 58-18, on the Mesabi, and just east of the Mountain Iron mine. The shaft at the principal test pit is down about 130 feet, 90 of which is in ore of a fine quality. A drift has been run northeast 181 feet in solid ore and a further shaft at the end of this drift has been sunk about 30 feet which is bottomed in ore. It is the intention of the company to put in machinery and a force of men at once.

The Mansfield mine has a stock pile of 25,000 tons and expects to add at least 12,000 tons before navigation opens, says the Crystal Falls *Diamond Drill*, which adds that the management hopes to increase last year's 75,000 tons record by 25,000 tons.

The Lake Angeline Co. have contracted for an electric haulage plant for their mine, and will have it completed by early summer. There will be an 85 horse power generator, two 30 horse power mining locomotives and 3,500 feet of track and trolley constructed. The company have also let a contract for 40 two-ton train cars.

As an experiment that may or may not be extended to their other workings, the Iron Cliffs Co. put the eight-hour system to the test at the Saginaw mine, beginning with March. Two eight-hour shifts are run; the third shift is omitted in view of the necessity to limit production.

The damage to the Ashland mine by the flooding of two weeks ago will be costly, but the interruption will not be serious, as the water can probably be pumped out in a few weeks In the winter months, much of the ore removed from the mine has come from above the tenth level, which was the hight of the water. Whenever shaft sinking was in progress, work has been suspended. It is estimated that there are 4,500,000 gallons of water in the mine. It is possible that when the mine is freed of water, a large lens of ore will be found, from which the flood issued.

At the Norrie, 400 men have been discharged. President Curry gives the unpromising outlook in the ore market as the reason and adds that there is no excuse for mining ore, in view of the prices which some furnacemen have been talking of. The company do not propose to exhaust their ore without

getting a price that will realize a profit. No sales have yet been made in spite of the plentiful rumors that have beenconnected with the Norrie for some weeks past. Measurements taken on Friday, 3d inst., showed that the pumps and bailers had got the upper hand, after 11 days, and the water was lowered a foot Friday afternoon.

FOUNDRYMEN GETTING CLOSER.

The Twenty-second meeting of the Foundrymen's Association was held at the Manufacturers' Club, Philadelphia, Wednesday evening, March 1, the President, Mr. Francis Schumann in the chair. The following were present: J. W. Gephart, Valentine Iron Co., Bellefonte, Pa.; J. Hy. Pepper, the *Iron Age*, Philadelphia; James Marshall, Hostetter Connellsville Coke Co., Pittsburgh; Fred. B. Lott, Sec'y., Davis Coke & Coal Co., Baltimore; C. L. Prince, Camden Iron Works, Camden, N. J.; George P. Smyser, E. G. Smyser's Sons, York, Pa.; Walter Wood, R. D. Wood & Co., Philadelphia; J. M. Wanner, Mellert Fdy. & Mach. Co., Philadelphia; L. B. Whitney, and Chas. H. Whitney, of A. Whitney & Sons., Philadelphia; Arthur W. Howe, Philadelphia; J. L. Delaplain, United States Fdy. Co. ,New York; Theo. B. Rohrman, Philadelphia; Thomas Glover, Glover Bros., Philadelphia; W. H. Hunt, Wm. Adams & Co., Philadelphia; S. G. Flagg, Jr., Stanley G. Flagg & Co., Philadelphia; G. R. Rebmann, G. Rebmann & Co., Philadelphia; W. C. Henderson, Thomas Devlin & Co., Philadelphia; James S. Stirling, Harlan & Hollingsworth Co., Wilmington, Del.; Isaac R. Newkirk, Wm. Wharton, Jr., & Co., Philadelphia; H. M. Kolb, Lansdale Iron Works, Lansdale, Pa.; George T. Johnson, Thomas Iron Co., Hokendaqua, Pa.; Andrew Mc Cardell, Pond Machine Tool Co., Plainfield, N. J.; Justice Cox, Jr., Mahoning Rolling Mill Co., Danville, Pa.; Josiah Thompson, J. Thompson & Co., Philadelphia; George R. Walker, J. Thompson & Co., Philadelphia; Chas. R. Schmidt, Hy. Mc. Shane Mfg. Co., Baltimore; G. T. Marsh, Supt., S. Baltimore Foundry Baltimore; Thomas Hobson, the *Iron Age*, Philadelphia; George Mitchell, Mitchell & Sheppard, Philadelphia; W. S. Hallowell, Harrison Safety Boiler Works, Philadelphia; Wm. Adams, Wm. Adams & Co., Philadelphia; Thomas Devlin, Thomas Devlin & Co., Philadelphia; Hy. Ruhland, Hy. Ruhland & Co., Philadelphia; W. H. Pfaehler, Abram Cox Stove Co., Philadelphia; Francis Schumann, Tacony Iron & Metal Co., Tacony, Philadelphia; Guyon Miller, Secretary, Downingtown Mfg. Co., Downingtown, Pa.; Abram S. Patterson, Mahoning Rolling Mill Co., Danville, Pa.; A. B. Paxson and Howard Evans, J. W. Paxson & Co., Philadelphia; Frank R. Jones, Jerome, Keeley & Co., Philadelphia.

The executive committee reported that the subject of coke for foundry use is an important one, and it is their wish to continue the discussion and invite representatives from different coke sections of the country to instruct the foundrymen regarding its adaptability for fuel in the cupola in comparison with coal and the analysis of same. The address by Mr. Jones, Wister, regarding coke, at the February meeting, has been appreciated and a number of inquiries from different parts of the country have been received asking for further information regarding the quality and adaptability of coke, brought about by his address.

The secretary has been instructed to send out bills for dues to Nov., 1893, which is the end of our business year. This is done to save book-keeping and make a starting point for all members. The treasurer reported a balance of $99.76 and all bills paid.

The following new members were elected. Abendroth Bros., Port Chester, N. Y., manufacturers of soil pipe, stove plate and small castings; the Vulcan Iron Works Co., Seattle, Washington, iron, brass and architectural work; Thomas Iron Co., Hokendaqua, Pa., Geo. T. Johnson, agent, 319 Willings alley, Philadelphia, manufacturers pig iron; Jerome Keeley & Co., 303 Walnut street, Philadelphia, pig iron and coke; Wilhelm & Co., Harrisburg, Pa., pig iron and coke; South Baltimore Foundry, Baltimore, G. T. Marsh, Superintendent, manufacturers of cars and general castings; Hostetter Connellsville Coke Co., James Marshall, agent, Pittsburg, Pa.

A discussion took place regarding the forming of sections in the association according to the kind of castings made. There are now represented in this association seven or eight branches of the foundry trade. A committee has been appointed representing each branch whose object is to report current prices for castings, that the members may know the actual market price. It is the further object of this committee to get the respective foundries making the same class of castings together, and talk over the possibilities of improving their conditions, hoping to make a combination looking toward procuring better prices for their work. The tendency of the times leans toward the combination of interests all over the United States, which seems to be the only reasonable plan to make business a success. The cutting of prices and the ill feeling now existing, which tend to the breaking up of organizations, must stop, and the sooner it is done the better for all concerned. This was the drift of the discussion. Mr. P. D. Wanner led most emphatically, stating that the time would come when combinations would be the rule, and all trades would come together, throwing aside prejudices and have an understanding that will result to their mutual interest. He stated that contracts for cast iron pipe were taken at one cent a pound at the works, which is the lowest ever recorded, and that it was impossible for any concern to make money at these prices.

Mr. George P. Smyser advocated the forming of sections according to the kind of castings made. He had already had some experience which was successful, and as a representative of the structural iron interest he would call them together and have an understanding at once, as he was satisfied it could be done without difficulty.

Mr. Flagg stated that the reporting of the average prices of castings was of no avail, as it did not cover the ground with any degree of certainty, and the only way to make a definite price at which castings were sold would be to report actual contracts taken.

President Schumann stated that each member of the committee representing the different branches should constitute the chairman of the section which he represented, and should make it his business to notify those whose interests were identical, and explain to them the necessity of joining this association and helping each other to make business a success.

It was moved and seconded that the president have power to appoint members of the general committee to represent branches of trade not already represented thereon. The president appointed the following persons to represent these trades: Soil pipe—Mr. Robt. J. Register, of J. Register & Sons, Baltimore; Loam castings—J. Sellers Bancroft, of Wm. Sellers & Co., Inc.; Sash weights—E. E. Brown, of E. E. Brown & Co.

On account of the lateness of the hour the discussion on coke and coal was postponed until the April meeting, Wednesday evening, April 5.

The meeting then adjourned to partake of the lunch, served by the association, in the roof garden of the club.

This was a very interesting meeting, and the sentiment favoring the combination of interests was appreciated and received with favor as the only way for future success.

After the lunch, addresses were made by Messrs. W. H. Pfaehler, of the Abram Cox Stove Co., and Abram S. Patterson, of the Mahoning Rolling Mill Co., who represented the Manufacturers' Club before the Senate committee, at Harrisburg, to defeat the employers' liability bill, which makes the employer liable to his employes for accidents or damages to the fullest extent. They both stated that it was quite probable that their efforts were successful, and that the bill would no doubt die in the committee. Other remarks were made tending to the success and usefulness of this association. Howard Evans, secretary of the association, may be addressed at Pier 45, N. Delaware avenue, Philadelphia.

THE Illinois Cycle Co., of Chicago, are to have a building 50 x 150 feet, two or three stories high, at Sacramento and Carroll avenues. They have already invested $25,000 in plant and equipment and have a large part of their output for 1893 sold in advance. They will be able with the new plant to turn out 1,000 to 1,500 bicycles a year. They will be in the market for a gas or electrical engine, for blower, drills, drop presses, dynamo, emery wheels, files, fire brick and clay, lathe, gear-cutters, pulleys, hangers, milling machines, etc. Orders can be filled from the works at Sacramento and Carroll avenue, by Jan. 1, '94. H. J. Winn is manager.

LAKE COKE-MAKING.

PIG IRON POSSIBILITIES OF MARQUETTE.

BY RICHARD A. PARKER.

TO THE EDITOR OF THE IRON TRADE REVIEW:

In a recent communication* to your columns it was suggested that in a subsequent letter figures would be given to you by me, supporting the assertion there made relative to the quality of the coke that has been produced from coal stored in the fall and coked during the winter months. The object of this letter will be to show first that this district, being drier than the Connellsville region, has that advantage over it in preventing losses due to a humid atmosphere and, second, that the natural advantages found here in the matter of great variety of ores of all grades, to be had cheaply, are of sufficient weight to offset any loss that might occur by reason of having to bring fuel to the ore.

In order to know just the character of the coke produced at the head of the lake, I addressed an inquiry to the makers and have received in reply the following letter:

LEHIGH COAL & IRON CO.
WEST SUPERIOR, WIS., Feb. 7, 1893.

Richard A. Parker, Esq., Consulting Mining Engineer, Marquette, Mich.

DEAR SIR: Replying to your favor of the 1st, regarding theoretical losses in the quality of coking coals by weathering, I beg to advise you that Mr. Pechin's statements are not borne out by our experience with the coking of Connellsville coals. With the single exception of the West Duluth Furnace Co., none of our customers have ever made serious complaint regarding the quality of our coke.

I beg to give you below results of our last analysis (just made) of coke which we had burned, from coal received last October, and which had consequently been exposed to the weather on our dock here for about five months. You will see that this analysis compares favorably with Eastern cokes.

†Moisture	.95
Volatile matter	.85
Fixed carbon	87.40
Ash	10.80
Sulphur	.97

Our average yield of coke is, say, 64 per cent. the weight of the coal.

Yours very truly,

LEHIGH COAL & IRON CO.

AVERAGE ANALYSIS OF COKE.

In order to show just how this coke compares with the average coke produced, presumably at the coal fields, I have obtained the average of the elements in the coke for the establishments reporting the grade of coke made to the Commissioner of Labor, in his report for 1890, upon p. 235. The names and locations of the plants are not given—but, from nine reports the average percentage of water was .50; from ten reports the average percentage of vol. and comb. matter was 1.48; from ten reports the average percentage of fixed carbon was 85.70; from nine reports the average percentage of sulphur was 1.165; from nine reports the average percentage of ash was 10.69.

From a pamphlet published by the H. C. Frick Coke Co., of Pittsburg, the following analysis of Connellsville coke is given on page 5 by Prof. McCreath of the Pennsylvania State Laboratory:—

Water at 225 degrees	.030
Volatile matter	.460
Fixed carbon	89.576
Sulphur	.82
Ash	9.113
	100.000

There can be no question that the coke represented by the analysis of the Lehigh Coal & Iron Co. would be considered fully equal to the average coke produced anywhere. In a letter recently received by me from Mr. John Fulton, general mining engineer of the Cambria Iron Co., Johnstown, Pa., he says amongst other things: "I am convinced that an exposure of four or six months would have little effect on any fairly good coking coal." And his opinion is very forcibly endorsed by the coke produced at West Superior.

THE QUESTION OF MOISTURE.

Wishing to know what the difference in moisture in the atmosphere between Pittsburg (the nearest reporting station) and Marquette is, I have obtained from the Weather Bureau, Washington, D. C., the following statement, given in Table 1, which conclusively proves, that there is far less water in the air in this district than in Pittsburg or Chicago, and further that during the months in which coal would be stored, (that is, from the beginning of November until the middle of May) the absolute humidity *is extremely low* at Marquette, the average for these six months being only 1.19 as compared to 2.03 for the same period at Pittsburg. The importance of these figures is seen when it is remembered that during the period of high humidity the coal will be coked about as fast as it is delivered.

The figures opposite "dew point temperature" indicate the monthly mean dew point for each month of the last half of the year, and the first half of the previous year, also the annual dew point. The figures underneath the dew point temperatures at each station indicate the absolute humidity in grains of water per cubic foot at each of the different dew point temperatures.

I would also like to give your readers a table showing the monthly rainfall and mean relative humidity of Marquette and and Pittsburg, the figures of which have been obtained through the courtesy of the local observer, Mr. P. McDonough. See Table 2.

The average mean relative humidity at Pittsburg is thus 72.2, and at Marquette 68.0. By relative humidity is meant the ratio which the amount of vapor actually present in the air bears to the amount which the air would contain if it were saturated.

The tables, given elsewhere, show conclusively that if moisture is a disadvantage to a stored coal and causes its decomposition even partially, that this district offers advantages not to be found nearer the seabord for the making of coke.

COST OF MAKING COKE AT MARQUETTE.

From the H. C. Frick Coke Co. I have obtained a figure of $1 per ton for coal on cars at the mine, and a rail rate to Cleveland or Ashtabula, of the same amount, or $2 per ton for Connellsville coal delivered at lake port. Assuming a 64 per cent. yield of coke from coal, we would require 1.56 tons of coal to make one ton of coke.

TABLE 1.—*Showing dew point and absolute humidity at Chicago, Marquette and Pittsburg.*

Stations.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Annual.	
Chicago.....	60	57	50	42	30	22	10	19	24	33	44	56	37	Dew point temperature.
	5.75	5.20	4.08	3.07	1.96	1.45	0.87	1.28	1.58	2.20	2.89	5.02	2.56	Absolute humidity—grains of water to each cubic foot.
Marquette.	51	50	43	33	22	13	0	2	13	25	36	47	28	Dew point temperature.
	4.22	4.08	3.29	2.20	1.45	1.46	0.56	0.62	1.46	1.64	2.47	3.68	1.83	Absolute humidity—grains of water to each cubic foot.
Pittsburg..	62	58	51	46	36	31	20	34	32	36	49	61	43	Dew point temperature.
	6.14	5.37	4.22	3.55	2.47	1.97	1.32	1.99	1.98	2.47	3.94	5.95	3.29	Absolute humidity—grains of water to each cubic foot.

TABLE 2.—*Showing monthly rainfall and mean relative humidity.*

		Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Marquette.	Rainfall	0.91	2.05	0.74	0.94	2.43	1.21	4.04	2.11	3.24	2.58	2.88	2.01	28.14
	Mean relative humidity	63.3	69.8	67.1	68.0	67.7	66.9	69.1	67.1	68.6	70.2	68.1	70.3	
Pittsburg.	Rainfall	4.82	4.57	3.71	1.11	3.48	1.71	5.52	3.40	2.47	2.43	1.50	3.40	38.12
	Mean relative humidity	81.2	80.5	74.7	63.4	65.6	69.4	70.7	69.4	69.0	72.3	69.3	80.7	

*See issue *The Iron Trade Review* for Feb. 9, 1893, article entitled "Lake Superior Coke Making."

†This is the coke that the furnace has been run upon, and has yielded in cupola practice, a melt of ten pounds of metal for each pound of coke for a period of six months.

Estimated cost of one ton coke (Marquette):

1.56 tons coal @ $2 per ton on cars	3.12
Loaded on boat @ 12½c per ton	.20
Freight to Marquette @ 50c per ton	.78
Unloading at 25c per ton	.39
Coking cost, including wear and tear, taxes, insurance, etc.	.50
	4.99

or a net cost of $5 per ton of coke, made here. To show further that 50 cents will cover the coking costs, it may be stated that Connellsville coke is selling (Feb. 23, '93) at $1.90 per ton at the ovens. It certainly will take one and one-half tons of coal (this assumes a 66 per cent. yield). Coal is worth at the same place $1 per ton, or coal for coking costs $1.50, leaving 40 cents as the cost of coking *and profit.* To still further verify this cost, reference was had to the report of the Commissioner of Labor, and on page 241, for 31 establishments reporting for the years 1888, 1889 and 1890, the following items of cost are given, for making coke:

Elements of cost.	Tons of 2,000 pounds.	
	Cost of 2,036,183 tons.	Average cost per ton.
Coal for coking	$2,481,742	$1.219
Labor	726,173	.357
Officials and clerks	58,119	.028
Supplies and repairs	118,011	.058
Taxes	9,528	.005
Interest	11,316	.006
Depreciation of plant	2,000	.001
Total	$3,406,889	$1.674

Tons of coal used in production, 3,166,308.
Average pounds of coal necessary to make one ton (2,000 pounds) of coke 3,110, making a 64.3 per cent. yield.

If we deduct the cost of the coal used in coking, $1.219, from the total average cost of a ton of coke $1.674, we find that the labor and other expenses amount to 45.5 cents per ton. So that it may fairly be taken as proved that the cost of coking should not exceed 50 cents, as estimated.

Another item of cost that may be reduced is the cost of freight on the coal from below: during the season of navigation there are numbers of vessels that would be glad to take up coal rather than run empty, and a rate of 30 cents per ton is quite common, while 40 is nearer the going rate than 50. Still it is safer to take the maximum figure in all estimates of this nature.

COST OF MAKING PIG IRON AT CHICAGO.

"Never before in the history of this country has pig iron sold at the low figure it now commands, and if with the present ruling prices, prices at which it is admitted many of the best furnaces are unable to get a new dollar for an old one, they continue running, it is in the belief that the present depressed condition cannot last, and when the change does come, they want to be in position to take advantage of it." Such is the general tenor of our late market reports and these are the times that try our iron men's souls. Let us see how they are faring in the iron market of Chicago. On Feb. 10, '93, the market quotation for Bessemer iron was given as $14 to $14.50 per ton.

The following table shows the actual prices of different grades of iron ore delivered at Lake Erie ports, during the past year:

Table showing prices of iron ore for the year 1892.

	April 1.	July 1.	Oct. 1.	Dec. 1.
Marquette speculars, low phosphorus	$6.00	$5.75	$5.50	$5.25
Marquette speculars, Bessemer grade	5.50	5.50	5.25	5.00
Bessemer hematites	4.50	4.00	3.85	3.85
Non-Bessemer hematites	3.75	3.50	3.35	3.25
Specular and other hard non-Bessemers, best grades	4.85	4.25	4.15	4.15

The average lake freight from Marquette to lower lake ports was $1.05 per ton; the rail freight, 45 cents; insurance five cents and one cent for bill lading loss; so that $1.56 is to be deducted from the above prices in order to obtain the value of the ore at the mine. In the case of ore going to Chicago, Ill., there would be a saving of about 15 cents per ton over lower lake ports, or, say the freight is $1.40 per ton of ore. If, now, an ore yielding 60 per cent. in the furnace is shipped to Chicago, there would be required to make one ton of pig iron, one and two-thirds tons of ore.

Estimated cost of making one ton Bessemer pig iron at Chicago.

1⅔ tons iron ore, at $4 per ton	$ 6.67
1 ton (2,000 lbs.) coke at $4.65*	4.65
4-10 tons limestone at $1.25 per ton	50
Labor, interest, taxes, repairs, etc	2.00
Total	$13.82

Estimated cost of one ton Non-Bessemer pig iron at Chicago.

1⅔ tons ore at $3.25, (actual furnace yield, 62 per cent)	$ 5.58
2,000 pounds coke at $4.65 per ton	4.65
Limestone, 1/10 tons, at $1.25 per ton (del'd)	50
Labor, interest, etc	2.00
Total	$12.73

In place of all ore some scrap or cinder may be used, but the grade of the iron will be apt to suffer, and the iron contained in them must have been paid for at some time. $6.67 is therefore, not far from the actual cost of iron and ore required to make a ton of Bessemer pig iron. The coke cost has been put as low as it is believed possible to put it and be near the truth. It will be admitted by all, that a furnace record of 2,000 pounds of coke for 2,240 pounds of pig iron, is conceding to the Chicago manufactures, all that they can fairly lay claim to in the way of economical fuel costs.

The last item of $2 for labor, interest, taxes, repairs, etc., is certainly 20 cents to low. Upon consulting the report of the labor commissioner for 1890, upon p. 68, I find that he places the average cost of labor, officials and clerks, supplies and repairs, and taxes at $2.204 per ton, as an average of the furnace practice of the Northern district, and $2.341 for the same item in the Southern district of the United States. In addition, there is no allowance made for cost of making sales, business losses, etc., in estimating the cost of making pig iron at Chicago. So it can readily be believed that there is little if any money in iron in Chicago at to-day's prices. There can not be an advance upon any of the cost items above quoted, even to a limited extent, and permit the furnaces to sell iron at a profit. Costs have all been stripped down to a fighting basis.

COST OF MAKING PIG IRON AT MARQUETTE.

Let us now see if there would be any advantage in coming to Marquette and getting nearer the ore. In the first place by doing so, the furnace has the option of buying and handling an ore that can not stand freight charges to lower lake ports. In the second place, he has a wider range of ores, both Bessemer and non-Bessemer, to draw upon—magnetites, specular, hematite, slate ore, "blue" hematite, red soft hematite, and finally, limonites. The amount of iron in these varieties of ores is entirely well known to all furnacemen, and the advantage of having at hand a great variety for mixing is also apparent to them.

And right here I wish to state, that I believe that the soft ore "fad" has had its day, and it will not be long before the hard ores will regain their former position in the market, with this difference, they will be crushed by the mines and delivered to the furnaces in a more convenient form for them to handle. The tendency of a hard ore in a furnace is to make the charge less dense, to prevent packing and to permit the reduction of the ore as rapidly as is the case of soft hematites; this is done by maintaining air spaces or passages for the reducing gases to ascend and intimately mix with the charge. The reduction of the iron is thus facilitated, increasing the yield of the furnace. It costs more to mine a ton of hard ore than one of soft ore, but, if the difference in cost is not too great, there are furnace men who would be glad to get the ore at a slight increase of cost, unit for unit.

A non-Bessemer ore has been and can be delivered at Marquette, yielding 53 per cent. in the furnace, *for $1.45 per ton at the furnace yards.* This serves to show that low grade ores will be sold cheaply by the mines, if any one wants them; they are of no use to the mining company, and often there are large amounts of this grade of ore that have to be mined to reach better ore, and the companies would be glad to dispose of them at a nominal figure. I have no hesitation in stating that a furnace could be furnished with ore, running from 53 to 57 per cent., for years to come, at a price not exceeding $1.65 per ton. In

*This price was obtained from *American Manufacturer*, of issue Feb. 10, 1893.

Bessemer ore, the saving is quite as large, as the same is true of it as of non-Bessemer; but the outside demand is likely to be somewhat stronger and the companies are apt to use up their low grade ores by mixing them with ores of a higher percentage of iron. Still, they are to be had in *greater variety and cheaper here than at any other point in this country.*

Another item of saving to a mining company in disposing of ores to a local furnace is the insurance charge of 3 to 5 cents per ton, and the one per cent of the weight of the cargo deducted from the bills of lading. These items of saving might fairly be divided between the mine and the furnace. The following would be a fair estimate for making one ton of coke iron:

Cost of Bessemer pig iron at Marquette.

1 ton hard ore, 56 per cent., and 8-10 ton soft hematite, 60 per cent. (allow 10 per cent moisture) at $2.25 per ton	$ 4.25
4-10 tons limestone @ $1.50	60
2,300 pounds coke @ $5.00	5.75
Labor, etc.*	2.00
Total	$12.40

Cost of foundry pig iron at Marquette.

1 9/10 tons ore @ $1.55, (delivered to furnace)	$ 2.95
Limestone, 4/10 tons, @ $1.50 per ton	60
Coke, 2,300 pounds, @ $5 per ton	5.75
Labor, etc.,*	2.00
Total	$11.29

This grade of pig would sell at $13 to $13.50 per ton in Chicago, which would leave from $1.71 to $2.21 above Chicago selling price, as a margin of profit when shipping iron to competing points west, or to any point upon the lakes.

THE BALANCE IN MARQUETTE'S FAVOR.

We have then the following table of estimated costs at the two points:

	Bessemer.	Non-Bessemer.
Chicago	$13.82	$12.73
Marquette	12.40	11.29
Total	$ 1.42	$ 1.44

Showing net difference of about $1.45 per ton in favor of this port as against Chicago. In this connection it is proper to note the narrow margin that exists between the cost and selling price of a ton of pig iron in Chicago, and that, while they would about get a new dollar for an old one at Marquette there would be a comfortable margin of one dollar and a half per ton.

This difference in favor of Marquette is by reason of the saving in rail and vessel freight, (and insurance) on one and two-thirds tons of ore. The freight to Marquette is 40 cents; to Chicago, $1.40, showing a saving of $1 per ton of ore, or $1.67 on ore for a ton of pig iron. In addition there are ores available for furnace use which can be bought for from 50 to 75 cents per ton below market price. This means an added saving of from 75 cents to $1 per ton, say 87½ cents. We have to pay for coke, $5.75 as against their $4.65, or a difference in their favor of $1.10. Our account, therefore, is as follows:

Saving on freight	$1.67½
Saving on cheaper ores	87½
Total	$2.55
Less difference of coke cost	1.10
Difference in favor of Marquette per ton of pig iron	$1.45

The figures here given are not theoretical, fictitious or forced in any way, as they can be verified by the smallest amount of investigation, and they should appeal with telling force to those iron-masters who have for the past year been on tha ragged edge of dispair, as prices have faded and fallen away, until there is nothing left but to close down and hunt a location where their raw materials can be more economically assembled. With the chain of lakes to afford cheap freights, pig-iron can be made here and placed in Buffalo cheaper than the raw materials can be obtained and iron made there.

With the advent of the new railroad running between Marquette and Ishpeming, direct connection can be made by two roads to the Chicago & Northwestern, and by the building of about 12 miles more road, the other great trunk line, the Chicago, Milwaukee & St. Paul road will be reached. In the Duluth, South Shore & Atlantic, we have already a direct through line, via the Canadian Pacific to the east or west, so that there can be no dearth of railroad transportation; for seven months in the year vessels ply on the great lakes from Buffalo, N. Y., to Duluth, Minn., thus affording water communication, which means cheap freights to any point on the great water highway between these two points.

The demand for pig iron is growing upon us and the increased output can only come from furnaces that can make cheap iron. Old plants that have outlived their usefulness, will have to give way to more modern ones, with appliances better fitted for the work, better located for assembling their raw material at low cost, nearer the center of demand, and having the necessary transportation facilities. Marquette has all the natural advantages above cited; the field is waiting to be occupied by men of intelligence, experience, energy, pluck and money.

MARQUETTE, MICH., Feb. 25, 1893.

*It will be noted that the amount charged for this item is the same as that charged against Chicago; if it is increased there, it would be here also, but for comparison, it is made the same.

THE American Engine Co., of Bound Brook, N. J., issue the following explanation of the shut-down of their works last week: "A most thorough and carefully conducted series of tests, just concluded, has convinced us that our engine, in its present shape, does not come fully up to the high standard of efficiency and durability which we have confidently been aiming to attain. Under these circumstances we are unwilling to encourage would-be customers to give us their orders, until we are in shape to offer them an engine that will fully meet the most exacting requirements as to economy in steam consumption, close automatic government, durability and every other essential feature. When we have attained that end, as we are confident we shall in due time, and are able to offer a superior engine which we can guarantee in every particular, we will advise you."

THE Pittsburg *Dispatch* says that the laying out of 16 new furnaces was begun at Homestead recently, and they will be in operation Aug. 1. They are for use solely in the manufacture of nickel steel armor plate. The Harvey processes will be employed and 150-ton plates will be turned out, while 50-ton plates have been the maximum heretofore. There is a rumor that the 33d street plant will be removed eventually to Homestead. At this mill most of the company's orders for steel structural material are filled. The output is about 300 tons a day, and 1,000 men are employed as against 1,600 when the output was iron. In addition to the changes in the armor plate department, the 23-inch and 33 inch mills will be entirely rebuilt. This, with the introduction of new labor-saving machinery, will give an increased output with fewer employes.

THE suits of S. J. Ritchie against the Canadian Copper Co., and the Anglo-American Iron Co., for the dissolution of these corporations, were dismissed Feb. 27, by Judge Hutchins, in the Common Pleas Court at Cleveland, for want of prosecution. The attorney and officers of the two companies were present ready for trial, but neither Mr. Ritchie nor his attorney was present. The latter was in another part of the Court House, and when a messenger from the judge informed him that the cases must be tried, the attorney ordered them dismissed.

THE new shed of the Pennsylvania Railroad Co., at Broad street, Philadelphia, will be, when completed, the greatest railroad shed in the world. The span will be 165 feet above the curb to the centre of the lantern; 300 feet 8 inches span from the centre of the pins; and 600 feet long. The shed will contain 16 tracks, and will have standing room for more than 200 cars. It will be, it is claimed, the best lighted and best ventilated train shed in the world.

THE North Shore Traction Co., of Lynn, Mass., have placed the contract for their new car shed with the Berlin Iron Bridge Co., of East Berlin, Conn. The building will be 103 feet in width and 300 feet in length, constructed entirely of iron and brick, in order to have the station fire proof. The same company are also making an addition to a car shed for the Wilmington City Railway Co., at Wilmington, Del.

A WELDLESS CHAIN.

A brief reference has already been made in these columns to the paper on "A Weldless Chain," read by Ludwig Herman, consulting engineer, before the February meeting of the Civil Engineers' Society, of Cleveland. The invention of Mr. Herman to which he thus called attention is an important one, and the details presented in the paper of great interest, as a study of strength of materials under strain. A liberal synopsis is given herewith, together with the illustrations presented by Mr. Herman on the occasion referred to.

The common welded chain with oval links is well known. I have seen specimens of the same, 200 and some more than 400 years old, made precisely as chains are made today. It is almost as simple to make a chain of this kind as it is to make cannon, and no doubt you all know how these are produced. You take a hole of the desired shape and dimensions, put a piece of suitable metal around it, and the cannon is finished.

There is but very little more trouble in making chains. The difficulty commences in using them. Here we are apt to encounter unsuitable material, poor welds, burned iron, unequal pitch, excessive friction, rapid wear, unstable shape and, in the case of anchor chains or cables, the stud, the shackle and other objectionable features.

Recognizing the great importance of a thorough understanding of all the conditions under which chain is manufactured and used, the board for testing iron, steel and other material appointed by the President of the United States in 1875, delegated this entire subject to a special committee. The very valuable report of this investigation and the results obtained thereby have assisted me materially in my labor. In the report referred to the chain link is divided into eight sections as shown in Fig. 1. Out of 435 links tested by the committee, 217 links or 49.9 per cent. broke at quarter weld, 116 links or 26.7 per cent. broke through the weld, 65 links or 14.9 per cent. broke at quarter butt, 21 links or 4.8 per cent. broke through the butt, and 16 links or 3.7 per cent. broke through the side.

This table proves that the quarter near weld and butt is even weaker than the weld and butt itself. The reason for this is

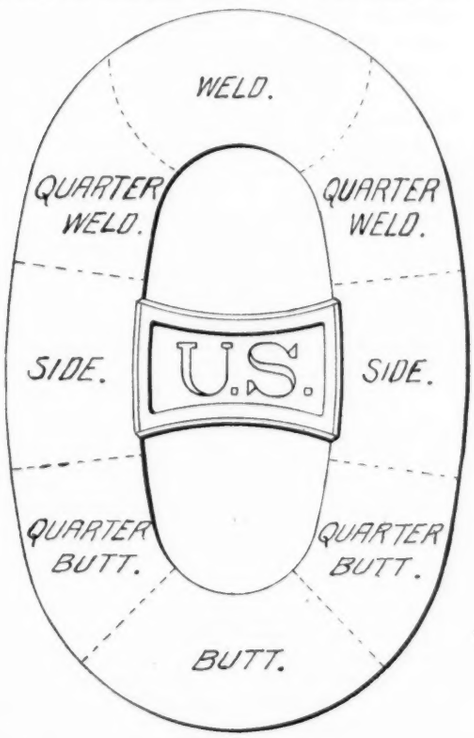


FIG. 1.

found in the fact that while the amount of material is about uniform at all sections of the link the strains at the quarters are excessive.

The strains in each link vary from point to point throughout its entire shape; in the middle of the sides they are strictly tensile, at both ends bending, while the intermediate quarters are subjected to a complication of tensile, bending and shearing strains. By the introduction of the stud the strains are still further complicated.

To produce an ideal link the cross sections would have to vary from point to point so as to be proportioned to the various strains acting at each successive point.

To accomplish this end and at the same time do away with the uncertainty of the weld, also to correct some of the other objectionable features of the oval link chain, I produced the device that I shall present to your criticism.

Each link of the chain shown in Figs. 2 and 3 consists of four separate parts, two straight side-bars—S, S—and two end pieces or yokes—Y, Y. The side-bars may be of any section, though I prefer to make them octagonal to facilitate the assembling or separating of the links. Each bar has both ends enlarged and threaded, one with a right hand thread, the other with a left hand one. Each yoke consists of a center part B that we may call the beam. This is provided at each end with an enlargement called the head—H, H. Each head has a threaded cavity in which the screw ends of the side-bars are secured. The side-bars do not screw up against any shoulder, for this would produce initial strains in the thread.

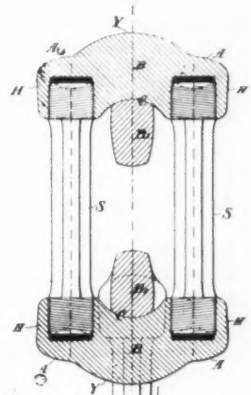
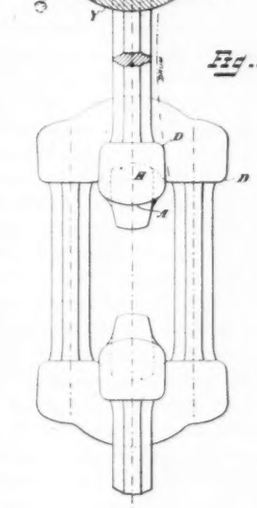


Fig. 2.



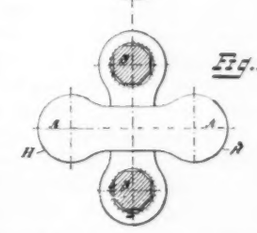


Fig. 3.

At B_1, B_1, the beams of the adjoining links are shown in cross-section. A chain made of links of this shape retains to the fullest measure the perfect flexibility of the ordinary chain at every joint. This flexibility is the reason why the old chain was never superseded to any extent by the many devices introduced for this purpose. Though each had certain advantages, all failed in this, the most desirable quality.

As in all chains, the load is transmitted from link to link at the center of the yoke. The yoke in my link acts as a beam loaded in the middle and fixed at both ends. From here the strain passes by means of their screw ends into the side-bars. The strains in each part and at every point of the entire link can be determined with the utmost exactness, and so I am enabled to provide at each point the amount of material required and put it in the most desirable shape for the duty it has to perform.

The side-bars require a material of high tensile strength combined with considerable elasticity or high resilience; it must be tough and stand any amount of use and even abuse without serious injury.

For the yokes the material ought to be somewhat harder and more rigid, for here stiffness and the ability to resist abrasion are additional requirements.

Having decided upon the material for the chain, I can proceed to determine the proportions of each part.

The ordinary chain is bought by the diameter of the bar whereof the link is made. For example, ½ inch, ¾ inch or 1 inch chain. This dimension does not give any information as to the strength of the respective chain, as the same size will according to quality of material and workmanship, give a very wide range in the ultimate strength of the link. For instance, a link made of 1 inch iron will, according to the standard of the United States Navy, have an average ultimate strength of 71,172 pounds; by Trautwine's table, 49,280 pounds; by test table of one chainmaker, 68,200 pounds; by test table of another chainmaker, 52,660 pounds, and so on. Each maker has

his own standard, and as stated above, the size of a chain conveys no information at all as to its quality, strength or pitch.

I propose to introduce my chain by numbers. These numbers will give all the information needed in selecting a chain for any given work. The method of deriving numbers and the formulas for pitch were then explained by Mr. Herman.

The point is often made in favor of the oval shape of chain links that they possess considerable elasticity of form, so to speak, in contradistinction to elasticity of material. The ellipse under any stress will lengthen in the direction of the great axis and shorten again when relieved. This action is destructive to the material, and leads invariably to a rupture. To remedy this the stud has been introduced, especially in heavy chains. But while the stud stiffens each link effectively it also introduces new complications of strains, and, as the U. S. Commission referred to above has clearly demonstrated, weakens the link and ought to be eliminated. In my link I depend entirely on the elasticity of the material and make the yoke, the only part subjected to bending strains, purposely as stiff and rigid as possible. In bridge building the only instance where a curved tension member is employed is the cable of a suspension bridge, or a curved bottom chord of some trusses. In all such structures bracing is introduced to counteract and eliminate the objectionable elasticity of form. The only conspicuous examples in mechanical engineering, outside of the oval chain link, are springs. These, while useful and sometimes indispensable, are not as reliable as other constructions and require frequent renewals. The link under consideration will, under ordinary use, retain its shape and dimensions practically unaltered—a very desirable quality where the chain is employed in connection with sprocket wheels. In such use the sprockets come in contact with the surfaces A, in Figs. 2 and 3, while in the ordinary chain the contact takes place at a single line. With this chain the wear and friction will be considerably less than with the old form. Where this chain is used on a drum or sleeve it will rest on the projections at D, D, thereby preventing the side-bar from coming in contact with the drum. In ship-cables it is sometimes necessary to divide the chain, to free the vessel from its anchor. In this chain every link can be quickly separated by turning the side-bars and unscrewing them. The shape of the yoke prevents entangling, and the use of the stud for this purpose, as in ordinary chains, is unnecessary.

Tests made at the Otis Steel Works and at Cornell University show that the ultimate strength of the chain will be from 97 to 100 per cent. of the strength of the two side bars. All perfect links tested broke in the side bars, and show decided necking at the point of rupture, as also do the bars not actually broken but subjected to the ultimate strain only.

In manufacturing this chain the side pieces will be rolled in octagonal bars, of uniform section throughout. These bars are then cut to the desired length and their ends upset. The yokes are produced from blanks by means of suitable dies in a drop hammer, or press. After annealing, both these pieces are placed in hoppers of an automatic machine, invented by me, that will do all the machining, assembling and proving and deliver the chain in a continuous piece ready for use. A machine of this kind is now under construction.

DISCUSSION.

The first question asked in the discussion of Mr. Herman's paper was by Mr. Rawson, who wanted to know as to the cost of weldless chain. "We have no positive date yet," Mr. Herman replied. "From tests made, we expect that the machine now building will produce one link, complete and tested, in the chain ready for use every minute." Responding to the inquiry of Mr. Ritchie, why such high-grade steel was used, rather than soft steel, which would stand 56,000 pounds, Mr. Herman said that for side-bars he intended to use steel that will stand 75,000 pounds, with an elongation of 20 to 25 per cent., this steel being used in car axles, and having a satisfactory record. Soft steel is rather low in resilience. Prof. Thurston in his work "The Materials of Engineering," speaks of the very grade of steel that is used in making the weldless chain and says that it should be employed where reliable material of high elasticity and resilience is needed.

Mr. Searles made a criticism of the device, prefacing it with a statement to this effect: Each side bar has a right and left screw so both ends of it may enter at the same time. Then both bars must be screwed into both heads at the same time. But these bars do not screw up to any definite point, nor are they seated against any shoulder. What prevents one of these bars from tending to turn a little? There is no pinching; each screw is loose in its own nut; and if on rough handling of the chain one of them is set out a little and the other set in a little, there is a cross-strain as between one bar and the other. One may act as a lock-nut on the other. Another point: Place the cables over a ship's side and the anchor bends them as they come in. Will they not tear out these nuts which are so slight?

Mr. Herman—My calculations are all based on ultimate rupture four or five times as high as any legitimate or even illegitimate strain that can get on my chain, and we know that if we stop within four-fifths of the breaking load we have a big margin to go on. In screwing together, the two wrenches used had to be moved precisely alike. Just as soon as one got the slightest bit ahead of the other, we had to stop and start over again. Four opposite threads in the same link make the most perfect locking device that can be found; it is absolutely safe against any accidental unscrewing. Actual tests in putting the links together show that less than five degrees advance in one bar against the other would bring the whole proceeding to a stand still.

Mr. St. John—How close do you think these threads ought to work?

Mr. Herman—Just as any machine screw ought to be made, so that they screw in without any undue resistance—what is called a good fit.

Mr. Palmer—Suppose the bars should back out one-third of the way, which is possible.

Mr. Herman—I can conceive of no cause that would unscrew one or both bars, no matter if they be loaded or not. The action of the four threads upon each other is a perfect lock. To unscrew a link, both bars must be turned with exactly the same speed and in opposite directions. This cannot happen by any accident.

In a report made by Prof. Thurston on the results of tests made in the mechanical laboratory of the department of experimental mechanics of Sibley College, Cornell University, he enumerates several points of advantage in Mr. Herman's chain: 1. It dispenses with welding and its uncertainties. 2. The liberty it gives of selecting material without reference to its welding power. 3. No heating or other injurious action upon the metal is required. 4. Materials may be selected, each for its place and purpose. 5. Exact proportions of the sections of link may be computed, securing least weight and highest tenacity of link and chain. 6. Under load the link is less liable to distortion by stress and to those variations of form that tend to fracture and granulation. 7. The only joints are mechanically made; thus the strength of the link can be fully the total strength of its side-bars. 8. Exact conformity to standard, secured by making the chain by machine. 9. The practicability of taking advantage of the octagonal section of the side-bar to make each link a shackle.

Personal.

Mr. Frank Shay, formerly manager of the New York branch of the Detroit Heating & Lighting Co., will represent the Capitol Heater Co., in New York, Eastern Pennsylvania, New Jersey, etc.

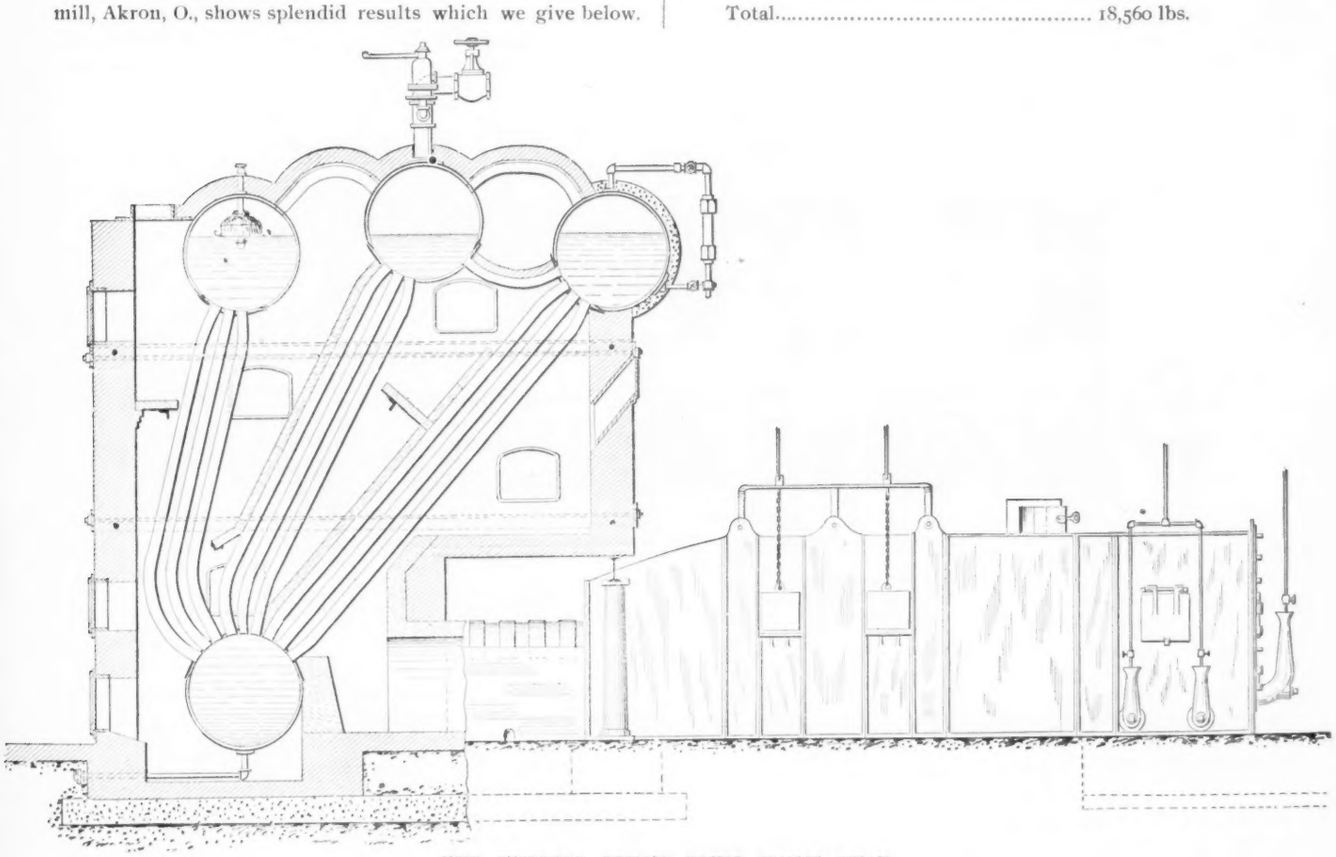
Chairman H. C Frick, of the Carnegie Steel Co., sailed for Europe, March 4, to get a needed rest. He will be absent several months. The officials and office employes of the company gave him a banquet at Pittsburg last week.

President, Henry M. Howe, Boston; vice-presidents, A. J. Bowie, San Francisco; Robert G. Leckie, Londonderry, N. S.; E. G. Spilsbury, Trenton, N. J.; managers: H. H. Campbell, Steelton, Pa.; W. L. Sheafer, Pottsville, Pa.; A. M. Shook, Tracy City, Tenn.; treasurer, Theodore D. Rand, Philadelphia; secretary, Rossiter W. Raymond, New York, are the officers of the American Institute of Mining Engineers elected at the Montreal meeting.

Mr. G. S. Merwin, the managing partner of the Chicago office of Rogers, Brown & Merwin, is recovering from the serious illness caused by a fall he received while in Tennessee some time ago, but will hardly be able to attend to business for another month. He has so far recovered, however, that all danger of a relapse is past.

THE STIRLING BOILER USING WASTE HEAT.

Many types of boilers have been designed for utilizing waste heat from heating and puddling furnaces, but there have been features in most cases which hampered their successful use, although as one large mill owner in the Mahoning Valley said, "We can well afford to replace 50 to 100 tubes every week because we get our steam for nothing." We present herewith an illustration of the Stirling water tube boiler, as applied to furnaces and if the success of this boiler by direct firing is any criterion, the demand for it for waste heat duty will be all that the manufacturers can desire. The Stirling boiler is now so well known that a description of its construction in connection with this new application is unnecessary. The standard boiler is used, leaving off the full iron front and turning the boiler fronting the neck of the furnace. As the cut shows, iron columns and bearers are used immediately above the furnace neck. The space occupied is not larger than that of any other boiler now on the market for this service. Owing to the construction of this boiler it handles bad water very successfully, and the cost of repairs and maintainance is reduced to the minimum. A test on one of these boilers at Akron Iron Co.'s mill, Akron, O., shows splendid results which we give below.



THE STIRLING BOILER USING WASTE HEAT.

This mill has other types of waste heat boilers in use, with varying bills for repairs, but the Stirling has now been running nearly a year and is giving excellent service, without costing a dollar for repairs.

Results of evaporative tests made on one 125 horse-power boiler attached to a heating furnace using Jame's steam blast at the Akron Iron Co.'s works, Akron, O., Feb. 13th, 1893:

DIMENSIONS AND PROPORTIONS.

The boiler is a standard "Stirling," having three steam drums and one mud drum, all 30 inches in diameter with 3¼ dia. tubes. Duration of test, 12.42 hours.

AVERAGE TEMPERATURES.

Of external air	39	deg. F.
Of fire room	43	"
Of steam	320.21	"
Of escaping gases	498	"
Of feed water	56.32	"
Of metal before charged to furnace	39	"
Of metal when drawn, white heat, or	2600	"

AVERAGE PRESSURES.

Steam pressure in boiler by gauge	75.97	lbs.
Atmospheric pressure per barometer	29.10	in.
Absolute steam pressure	90.22	lbs.
Force of draught in inches of water	0.203	in.

FUEL.

Kind of coal, lump from Wagoner's mine, Silver Creek, O.

Total amount of coal consumed	7,740	lbs.
Moisture in coal	5	per cent.
Dry coal consumed	7,353	lbs.
Percentage of refuse	12	per cent.
Total combustible	6,424	lbs.
Dry coal consumed per hour	592.2	lbs.
Combustible consumed per hour	517.4	lbs.

WATER.

Total weight of water injected into boiler and evaporated	46,640	lbs.
Equivalent water evaporated into dry steam from and at 212 degrees	54,510	lbs.

ECONOMIC EVAPORATION.

Water actually evaporated per pound of dry coal	6.20	lbs.
Equivalent water evaporated per pound of dry coal from and at 212 degrees	7.41	lbs.
Equivalent water evaporated per pound of combustible from and at 212 degrees	8.48	lbs.

There was charged to the furnace during the test in blooms:

Steel	15,660	lbs.
Iron	2,900	lbs.
Total	18,560	lbs.

This amount of metal absorbed in being heated to white heat: in b. t. u.	5,703,860
Heat derived from dry coal charged in b. t. u.	95,589,000

The heat absorbed by the metal represents 6 per cent. of the total heat from the coal; this taken into account would make the evaporation as follows:

Water actually evaporated per pound of dry coal	6.57	lbs.
Equivalent water evaporated per pound of dry coal from and at 212 degrees	7.854	lbs.
Equivalent water evaporated per pound of combustible from and at 212 degrees	8.98	lbs.

HORSE-POWER.

Horse-power developed: centenial standard, (34½ lbs. water per hour from and at 212 degrees)	128.3	H. P.
Horse-power builders rating at 11.5 sq. ft. per horse-power	125	H. P.
Per cent. developed above rating per cent.	1.26	

The boiler was run as in every day practice and no special arrangements or changes made. For making the bottom in furnace 675 lbs. of sand was used, which was drawn off as slag, and considering the great radiation surface and thin walls of

the heating furnace, the above must be considered excellent results.

The general office of the Stirling Co. is located in the Pullman Bldg., Chicago, and detailed information about the Stirling boiler, also prices, circulars, testimonials, etc., will be cheerfully furnished on application.

Against the New Sheet Metal Gauge.

Mr. Oberlin Smith, of New York, has taken ground in communications to two Eastern trade journals against the sheet metal gauge bill, just passed by Congress. He makes these comments:

"The absurdities apparent upon the face of it are sufficient to condemn it in the eyes of any systematic engineer. Among these are the ciphers (in one case extending up to seven) at the beginning of the series of size numbers instead of beginning with unity. Also the following of the old system of putting small numbers for the larger thicknesses, and *vice versa*. Also the actual sizes of the gauge dimensions themselves, which run in very curious fractions that are not measurable by ordinary tools. The only good and systematic thing about this proposed system is that the respective gradations agree with certain definite number of ounces per square foot of iron or steel, these two happening to be of about the same specific gravity. This very fact, however, makes the gauge unfit for measuring, by the same system, tinned or galvanized sheet iron, brass, copper, zinc, aluminum, silver, gold and other metals, as well as paper, leather, etc.; and it also makes it unsuitable for a wire gauge for all kinds of material, including iron. Exactly how the interesting groups of seven, and six, and five ciphers above mentioned are to be pronounced in speaking, we have not been informed. Just why we should have saddled upon us a law of this kind, after which we shall have to use various other gauges for wire, screws, rivets and nearly all the sheet metals, passeth ordinary comprehension."

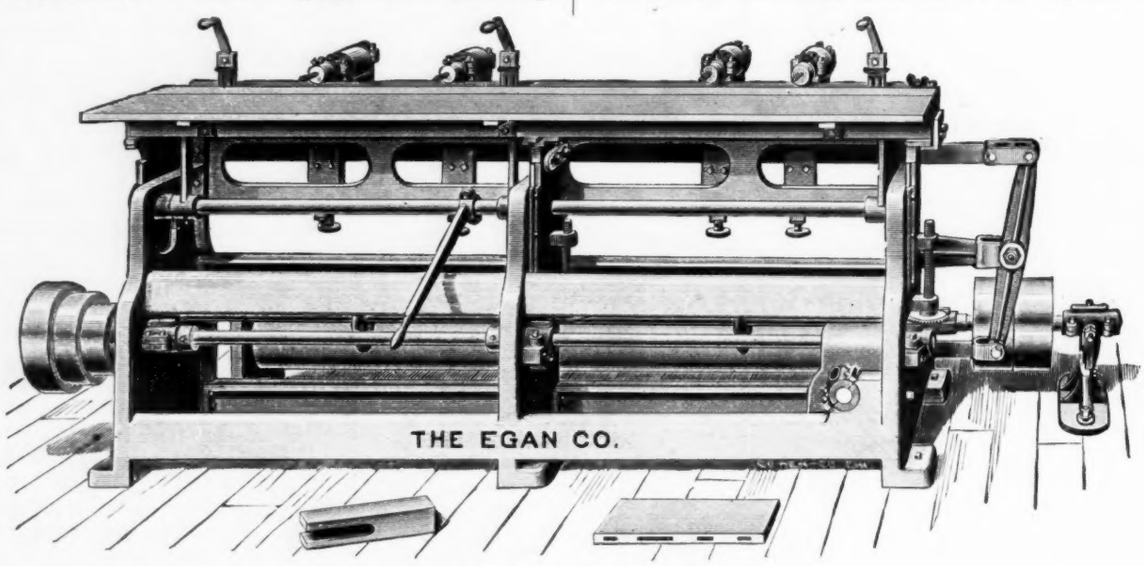
The iron and steel sheet manufacturers, the roofers' association, and the Amalgamated Association were united in support of the bill. If the confusion the iron and steel trades have so long endured can be saved, the new law will have been well worth enacting. The chief thing neeeded was to get the commercial interests, that have been the chief sufferers from the perplexing diversity of standards to agree on something. That the gauge on which they have come together does not tally with ideals that individuals may set up is not to the point.

ROGERS, BROWN & CO. have secured the exclusive agency for the output of the Watts Steel & Iron Syndicate, Ltd., of Middlesborough, Ky. The Watts Syndicate are making all grades of coke iron, foundry, soft and forge, and are also to make steel billets from Southern iron by the basic process. The location of the Watts furnaces will enable Rogers, Brown & Co. to secure advantageous freight rates to the North. The pig iron output of the Watts furnaces for the market is about 150 tons a day.

NEW MULTIPLE MORTISING MACHINE.

The machine illustrated herewith is a great labor saver besides being one of the most reliable mortising machines made. It will make almost any number of mortises, long or short, and of various widths, at the same time. It saves marking off the work, and is especially adapted for the furniture trade, sash, door and blind work, and a general run of woodwork. It can do the work of four ordinary mortising machines and every mortise made alike, or mortises of different widh, depth, or length can be made at the same time. It can also be used as a multiple borer.

The cut shows the machine made with four mandrels, each controlled by stops to regulate the length of mortise. Any number of mandrels can be added. The change from one length of stroke to another, is accomplished instantly, as is the number of mortises. The mandrels are of hammered steel, running in self oiled boxes, lined with babbitt, and each mandrel driven by a seperate belt from a countershaft furnished with the machine. The stock is clamped to the table by an ingenious device, and is made to rise and lower, and to move horizontally on planed ways, so that each mortise is cut absolutely true with the face of the stock. The feed consists of three changes to suit the length and size of mortise, so that short mortises can be made much faster than long ones, a decided advantage over any other machine of like character, now made. The makers and originators are the J. A. Fay & Egan Co., 251 to 271 West Front St., Cincinnati.



NEW MULTIPLE MORTISING MACHINE.

High Prices for Scrap Iron.

The price of wrought scrap in the leading iron markets of this country is about 50 per cent. of the base price of ordinary bar iron. In England the relative value appears to be only about 35 per cent., according to the best available information. It would seem therefore, that either wrought scrap is disproportionately high in this country or remarkably cheap in England. The inroads made by steel on the bar iron trade of the United States must sooner or later affect the price of wrought scrap. As it is not an article of staple production, but is a mere matter of salvage, the cause of its comparatively high price is difficult to comprehend. The law of supply and demand in this case seems to be inoperative. Stocks are understood to be heavy at various points, and there is certainly not a growing demand for the material from the bar iron manufacturers. Another matter in this same connection which is difficult of explanation is the tendency of old iron rails to advance in the West. Consumers of old rails have had no improvement in the price of their product to warrant the payment of more money for materials.—[Iron Age.

SINCE the reciprocity treaty with Cuba was made 16 months ago the 31st of December last, the exports from the United States to that island have been $28,869,263, as compared with $15,885,355, the exports for the 16 months ending Aug. 31, 1891—an increase of $12,982,908.

INDUSTRIAL SUMMARY.

New Enterprises:—

The following recent incorporations, specially reported for *The Iron Trade Review*, are of interest to the iron and machinery trade:

Oregon, Wis.—Badger Bi-Cycle Co.; capital, $3,000; for the manufacture and sale of bicycles and novelties; incorporators: C. A. Lathrop, I. Lathrop, A. B. Kingsley.

Freeport, Ill.—Magney-Cate Mfg. Co.; capital, $50,000; for general manufacturing business; incorporators: Joseph P. Magney, Rufus L. Cate, Clarence E. Cahoon.

Oakmont, Pa.—Verona Tool Works; capital, $120,000; to manufacture iron or steel or both, etc.; incorporators: Henry S. Paul, Harry W. Armstrong, Jennie Lee Paul.

Chicago, Ill.—Gay Gun Co.; capital, $100,000; to manufacture and deal in toy guns, milling machinery, etc.; incorporators: Louis Gathmann, Edw. Gilman, Frederick Ehlert.

Lincoln, Ill.—The Lincoln Washing Machine Co.; capital, $25,000; for manufacturing washing machines; incorporators: Frank Frover, Geo. W. Parker, E. F. L. Rautenberg.

East St. Louis, Ill.—Corey Steam Pump Co.; capital, $100,000; to manufacture steam pumps, and general machinery; incorporators: G. N. Scott, W. W. Corey, Jr., D. Strawbridge.

Chicago, Ill.—Breitling Metal Ware Mfg. Co.; capital, $75,000; to manufacture and deal in all kinds of metal ware; incorporators: Chas. Breitling, Gustav Stieglitz, Adolph Hartman.

Pittsburg, Pa.—Lawrenceville Bronze Co.; capital, $25,000; for the manufacture of iron or steel or both, etc.; incorporators: Geo. W. Gosser, John E. Haines, L. Reese Lindsay.

Beaver Falls, Pa.—Beaver Falls Planing Mill Co.; capital, $50,000; for the manufacture of iron or steel or both, etc.; incorporators: S. N. Douthitt, Simon Harrold, G. C. Wareham.

Milwaukee, Wis.—H. Mooers Co.; capital, $100,000; for manufacturing and dealing in steam heating apparatus, etc.; incorporators; H. Mooers, W. K. Dawney, T. E. Hoye, M. J. Yocom.

Chicago, Ill.—Ruebs Moulding Sandpapering Machine Co.; capital, $100,000; to manufacture and sell sandpaper machines; incorporators: Lester A. Brown, Robt. H. Wiles, Harry Bitner.

East St. Louis, Ill.—McMahon Machine Co.; capital, $100,000; to manufacture and deal in patent leather working machines, etc.; incorporators: Patrick Baggott, G. G. Weare, Wm. Baggott.

Chicago, Ill.—Columbian Bicycle Livery; capital, $10,000; to buy, sell, rent, lease, manufacture and trade in bicycles, etc.; incorporators: Chas. H. Silg, Archibald McLellan, Wm. R. Reid.

Chicago, Ill.—The Guerra Grip Co., capital, $100,000; to manufacture, sell and own patents for grips for cable cars, etc.; incorporators: Ralph Bradley, Hamilton Anderson, Adams A. Goodrich.

Newton, Ia.—Parsons Band Cutter & Self Feeder Co.; capital, $100,000; for manufacturing patented articles; incorporators: W. C. Bergman, G. W. Parsons, F. L. Maytag, A. H. Bergman, Newton, Ia.

Pittsburg, Pa.—The Veness Machine Co.; capital, $10,000; for the manufacture of iron or steel or both or of any other metal, etc.; incorporators: Wm. R. Hamilton, Alfred E. Veness, Wm. Heap, Wilkinsburg, Pa.

Norristown, Pa.—The Penn Tack Co.; capital, $25,000; for the manufacture of tacks, nails, rivets, etc.; incorporators: Wm. N. Easton, Pittsburg, Pa.; Harry J. Weiman, Pittsburg, Pa.; Jos. S. Rambo, Norristown, Pa.

Chicago, Ill.—Bracey Improved Spike Co.; capital, $100,000; to manufacture and deal in railroad spikes, supplies, etc., and do general manufacturing business; incorporators: M. J. Frost, B. M. Taussig, W. N. Williams.

St. Charles, Ill.—The Illinois Safety Heating Co.; capital, $6,000; to manufacture apparatus for general heating purposes; incorporators: C. A. Miller, Jno. Simpson, H. M. Young, Z. Simpson, T. F. Ryan, T. E. Ryan.

Pittsburg, Pa.—Pierpoint Boiler Co.; capital, $1,000; for the manufacture of iron and steel or any articles of commerce from wood or metal or both; incorporators: Julian Kennedy, Jas. Pierpoint, Pittsburg, Pa.; Geo. Reeves, Niles, O.

Chicago, Ill.—Western Telephone Construction Co.; capital, $100,000; to manufacture, buy, sell, lease and deal in electrical apparatus and material; construct and operate telephones or electric service exchanges, and buy sell, lease and deal in patents relating to the electrical industry; incorporators: Jas. E Keelyn, Geo. F. Stitch, Jno. F. Scanlan, Mills Kehoe.

Cleveland, O.—The U. S. Bronze Co.; capital, $100,000; for manufacturing and dealing in brass and bronze castings and ingot metals, etc.; incorporators: C. L. V. Evans, M. H. Farnsworth, W. C. Beckwith, Jno. N. Shephard, W. A. Price.

Bradford, Pa.—Victor Dish Co.; capital, $20,000; for the manufacture of dishes, pails and other like wares from wood, paper and metals and combinations thereof; incorporators: Alex. Watson, Wm. Meachem, Frank E. Lucas, Bradford, Pa.

Lebanon, Pa.—Lebanon Boiler Foundry & Machine Co.; capital, $70,000; for manufacturing boilers, engines, pumps, stiles, stacks, castings, pipes, etc.; incorporators: Jno. H. Cilley, R. G. Scarlett, Isaac Pott, Jno. K. Frank, Thos. Failer, of Lebanon, Pa.

Chicago, Ill.—North Pacific Cycle Co.; capital, $5,000; to manufacture and deal in bicycles and all kinds of vehicles, folding beds, mattresses, type-writers, stationary, tools, etc.; incorporators: Walpole Wood, Fred A. Bangs, Chas. A Day, of Chicago, Ill.

Montague, Mich.—Montague Iron Works Co.; capital, $56,000; to manufacture and sell steam engines, boilers and saw mill and other machines and machinery and apparatus; incorporators: Jas. D. Wilson, David M. Wilson, N. P. Hendrie, Montague, Mich.

New York, N. Y.—Empire Pure Water Supply Co. (incorporated in W. Va.); capital, $100,000; for manufacturing water purifying devices and other specialties for the promotion of health; incorporators: C. E. Campbell, H. R. Wilson, F. E. Wallace, New York City, N. Y.

New York, N. Y.—The "400" Pure Water Co. (incorporated in W. Va.); capital, $150,000; for manufacturing and operating and selling stills and condensers, or other apparatus for the distillation of water; incorporators: E. D. Simpson, Jas. Clarke, W. E. Dennis, New York City, N. Y.

New York, N. Y.—Automatic Gas Fuel & Incandescent Light Co. (incorporated in W. Va.); capital, $1,000,000; for making, selling and leasing to others the right to use the Tayler gas mixer and other machines; incorporators: Henry Wellington, Jas. A. Brown, J. Taylor, Chas. E. Mulke, all of New York, N. Y.

Anderson, Ind.—Johnson-Reynolds Co.; capital, $6,000; for the manufacture and sale of gas regulators and other machinery, appliances and articles, for the buying, selling and assigning patent rights and doing a general manufacturing business, as well as buying, leasing or otherwise owning and holding real estate for its business; incorporators: Jno. L. Kilgore, Myron G. Reynolds, Andrew J. Johnson.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review* and we will put you in communication with our advertisers at once.]

The Lebanon (Pa.) Boiler, Foundry & Machine Co. has incorporated, with $70,000 capital.

A tin plate mill is about to be established near Frostburg, Md. The capital invested is $15,000. W. R. Perry and others are interested. John J. Jones is manager.

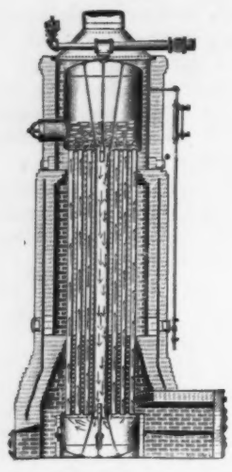
It is expected that the new steel sheet mill at Ellwood City, Pa., will be in operation in five or six weeks. From 75 to 100 men will be employed. Machinists are now at work installing the machinery.

The Grand River Foundry & Iron Mfg. Co., of Grand River, Lake Co., Ohio, are erecting roomy shops and foundry for the manufacture of the Wilson boiler, heretofore manufactured at Westfield, N. Y.

The newly incorporated Battle Creek Carriage Co., of Battle Creek, Mich., will purchase a boiler and engine, drills, emery wheels, injectors, files, pulleys, hangers, shafting and wood working machinery.

The Hill & Beatty Harness Co., of Decatur, Ill., manufacturers of harness and saddlery and jobbers in saddlery hardware will build shops 40x153, four stories high. They will purchase a boiler, engine, belting, derrick, drills, drop presses and dynamo.

Robt. Poultney, expert pattern maker at Wm. Tod & Co.'s, Youngstown, O., has leased the building formerly occupied by the Youngstown stove works and will start a foundry and



THE AULTMAN & TAYLOR MACHINERY CO.,

MANSFIELD, OHIO, U. S. A.

SOLE BUILDERS OF THE

Cook Patent Water Tube Boiler.

THE ONLY PERFECT WASTE-HEAT BOILER.

No incrustation.
Generates the greatest amount steam with least amount heat.
Repairs reduced to a minimum.
Can be used equally as well for direct firing or with natural gas.

WE ARE ALSO BUILDERS OF

HORIZONTAL, TUBULAR, AND FLUE BOILERS, LOCOMOTIVE, FIRE BOX AND ALL OTHER STYLES OF BOILERS, OIL TANKS AND WATER STAND PIPES.

Estimates furnished promptly on receipt of specifications.

Office, THE ROOKERY, CHICAGO.

SOUTH CHICAGO

A SUBSTITUTE FOR STEEL

IN

Cross Heads, Crank Shafts, Gears, Hammer Dies. Etc.

"McDOWELL'S"

"Semi-Steel"

Works: SOUTH CHICAGO.

FOUNDRY COM'Y.

AN ANTI-ACID METAL

FOR

Acid Pans, Smelting Kettles, Hydraulic and Ammonia Cylinders.

THE GARDEN CITY SAND CO., Room 53, 159 La Salle St., CHICAGO, ILL.

FIRE BRICK, FIRE CLAY,

For Blast Furnaces, Cupola Lining, Boiler Setting, Smoke Stack Lining, or Any Other Purpose.

EVERY CLASS OF SPECIAL SHAPES AND SIZES.

ALL KINDS OF

Foundry Supplies.

FACINGS, BLACKINGS AND MOULDING SANDS

Of All Kinds.

machine shop. He has patents covering a valve, and other valuable devices.

Additions, Enlargements, Removals, Etc.:—

Patch & Swift, founders and machinists, of Streator, Ill., are erecting a new steel crane, designed by their superintendent, A. L. Patch. It was made necessary by their increasing business in heavy castings.

Zanesville, O., dispatch: An Ohio River town, presumably Ironton, has offered the Ohio Iron Co., of this city, $60,000 and five acres of land to remove their plant there. Their works are now in full blast, notwithstanding the opposition of the Amalgamated Association.

The Oswego (N. Y.) Bridge Co. are figuring on a removal to Michigan. Corunna has offered $6,000 and a building site. Flint is also talked of, and the company will locate there if $6,000 is raised, saying nothing of building site. From 60 to 80 hands would be employed at the start.

The York Mfg. Co., of York, Pa., will erect new shops in the spring, including the following: Boiler house, 140x240 feet; foundry, 50x180 feet; blacksmith shop, 40x80 feet; storage house and office, two stories, 180x30 feet; machine shop and erecting room, 80x300 feet; pattern and tool house, two stories, 120x100 feet, and engine and boiler house, 30x80 feet.

Fires and Accidents:—

One of six boilers exploded at Tyler, McTurk & Co.'s colliery near Pottsville, Pa.

The Loveland Axe Factory, at Lamar, Pa., burned. Loss $5,000; insurance $3,000.

Columbia Paper Mill, Elmwood, Ill., burned, with $40,000 loss. Power equipment will be needed.

The works of the Kirkham Art Tile & Pottery Co., at Barberton, O., were destroyed by fire March 5. Loss, $240,000; insurance, $165,000.

The plant of the Fred. J. Meyers Mfg. Co., at Covington, Ky., manufacturers of hardware specialties, architectural iron, etc., burned March 5. Loss on this and adjoining property $350,000, insurance one-half.

An iron pulley on the dynamo at the electric street railway power house at Lowell, Mass., burst March 2. A piece struck the fly wheel of the engine, 20 feet in diameter, having a rim of iron three inches thick and making 72 revolutions a minute. It was smashed in an instant and the rim, which was made in sections, scattered in all directions, shattering the building. A ton section of the fly wheel crashed through the brick wall of the engine house and through the brick wall of the repair shop. The assistant engineer was killed.

General Industrial Notes:—

The Krehbiel Palace Car Co. will probably manufacture their cars at West Pullman, Ill.

The Carnegie Steel Co. are making steel electric light poles, an entirely new industry, at Homestead.

The Erie City Iron Works, Erie, Pa., are full of work, and present orders will keep them busy for some time to come.

The rolling mill of the Akron (O.) Iron Co. is running double turn in all departments. The puddlers have lost an occasional turn for want of coal.

The Bessemer, Mich., *Iron Spirit* says that J. M. Longyear has expressed his willingness to donate a 20-acre site for a blast furnace at Bessemer.

The U. S. Rolling Stock Co. are running two hammers, two top and bottom furnaces and one busheling furnace, at Anniston, Ala. Business is dull at present.

The Moundsville (W. Va.) Mining & Mfg. Co. held a meeting recently, and decided to continue to offer material advantages for manufacturing enterprises to locate there.

The liabilities of the Polsen Iron Works, at Toronto, recently assigned, are shown to be over $500,000. The assets are about $140,000. The creditors will realize little or nothing.

The Union rolling mill, Newburg, O., is running steadily in all departments, with a good supply of orders ahead. It has lost but four days, and those legal holidays, since last August.

The Pittsburg wire works, at Braddock, Pa., have been put on double turn. About 225 additional men are thus given employment. In all about 450 men are now working at this place.

A number of Eastern capitalists have formed a company with a capital stock of $100,000, to develop 600 acres of land near Marion, Ind., and on which a number of factories will be erected.

Fifty machinists struck at Carnegie's 29th street mill, Pittsburg, last week, for wages in force before Jan. 1. The com-

MOUNT SAVAGE FIRE BRICK.

UNION MINING CO.,

Proprietors of the CELEBRATED Mount Savage Fire Brick.

GOVERNMENT ⁂ STANDARD.

Established 1841. Capacity, 60,000 Per Day; 18,000,000 Per Year.

The First Manufactory of its Kind in the U. S.

Home Office and Works:—MOUNT SAVAGE, Allegany County, Md.

Branch Offices:—No. 1 Broadway, New York, N. Y.; No. 222 So. Third St., Philadelphia, Pa.; Lewis Block, Pittsburgh, Pa.

DIAMOND W&B DRILL

THE WHITMAN & BARNES MFG. CO.,
Manufacturers of DIAMOND BRAND TWIST DRILLS.

FACTORIES AT
Akron, O.; Syracuse, N. Y.; Canton, O.; St. Catharines, Ont.
STORES AND WAREHOUSES AT
Boston, Mass.; New York, N. Y.; Philadelphia, Pa., Cincinnati, O.; Chicago, Ill.; Kansas City, Mo.; San Francisco, Cal.; London, Eng.; Paris, France.

BUY HANGERS, COUPLERS, ETC.,

OF FIRST HANDS.

We make them from start to finish and carry a large stock from which we can ship any sized order the day it is received. SEND FOR CATALOGUE.

WAUKEGAN IRON & STEEL CASTING CO, 1319 Monadnock Building, CHICAGO, ILLS.

GENERAL ENGINEERING CO.,

GENERAL OFFICE AND WORKS: HARVEY, ILLS., SUBURB OF CHICAGO.

Designers and Builders of Improved Machinery for

PLATE GLASS WORKS, **ROLLING MILLS,**
NAIL FACTORIES, **IRON WORKS.**

Any kind of Special Machinery and Foundry Work. PUNCHING AND SHEARING MACHINERY OF LATEST DESIGNS. Our Works possess greatest capacity of any in or about Chicago for handling heavy machinery.
SEND FOR ESTIMATES.

pany says it can fill the vacancies. The men out are all skilled mechanics.

What is said to be the largest beam ever rolled was turned out at the Homestead mills, Feb. 28. It was made from a five-ton ingot, and finished into a 24-inch beam, weighing 100 pounds per foot.

The Maumee mill, at Toledo, O., has closed down permanently. The sheet and finishing mills have not been in operation since December. Supt. Chas. Borts severed his connection with the mill Feb. 28.

The American Engine Co.'s works, at Bound Brook, N. J., have been shut down and 200 men are out of employment. A dispatch quotes a statement from the company that their high speed engines did not work successfully.

No. 3 furnace of the Crane Iron Works, of Catasauqua, Pa., is being blown out, which will cause the discharge of about 40 men. This leaves but two furnaces in blast at these works, No. 6 having been blown out recently.

The Miller Foundry Co., of Youngstown, O., shipped to the Reeves Iron Co., of Canal Dover, O., a consignment of sheet mill rolls 24x40 inches in size, and also a shipment of muck rolls to the Pomeroy plant of the Union Iron & Steel Co.

At Chicago, Judge Gresham entered a decree in the case of the Central Trust Co., of New York, against the United States Rolling Stock Co., ordering the immediate sale of the company's plant and property at Hegewisch. Total amount due is $2,207,541.75.

The Builders Iron Foundry, of Providence, R. I., has received the contract for 28 spring return carriages for 12-inch breech-loading rifled mortars. These carriages weigh about 42 tons each, and are to be used for coast defense in connection with the rifled mortars made by this company.

The Lloyd Booth Co., of Youngstown, O., have shipped large lever shears to the Illinois Central Railroad Co., at Chicago. They also have orders for large shears for the Union Iron & Nail Co., and the East Chicago Iron & Steel Co., of East Chicago, Ind.; and an order for a Morewood tinning set from the Blairsville (Pa.) Tin Plate Co.

The receivers of the Pottstown Iron Co. have submitted a statement showing assets of $2,806,061, and liabilities of $2,587,901. The obligation of the capital stock, amounting to $884,800, is included above; deducting this the amount owed to creditors is $1,703,101.08. The expectation is expressed that he company will pay dollar for dollar.

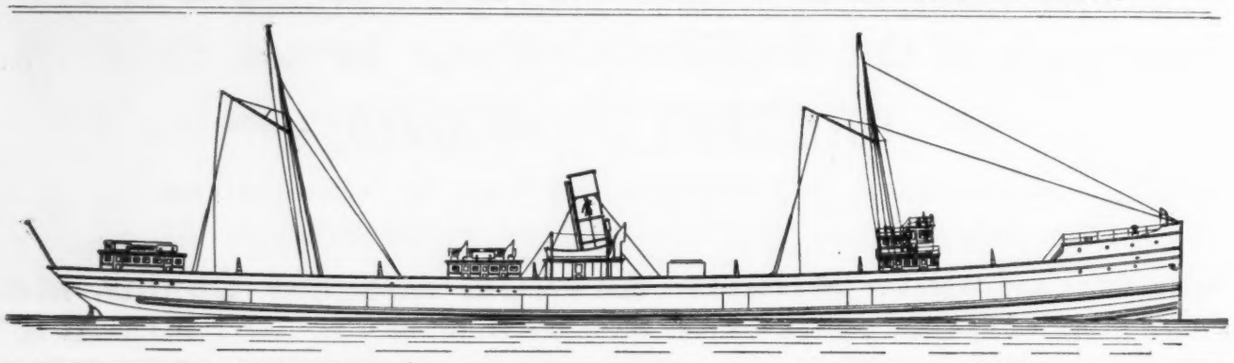
The Laidlaw & Dunn Co., of Cincinnati, and the Gordon Pump Co., of Hamilton, O., have agreed on a consolidation, to be called the Laidlaw-Dunn-Gordon Co., capital stock $700,000. The consolidated company will soon begin the erection in Cincinnati, or its immediate vicinity, one of the largest pump and hydraulic works in the United States.

The latest triumph of ingenuity brought out by the Egan Co., of Cincinnati, O., has just been awarded the "medal of superiority" by the American Institute, of New York City. The machine that was given such high honor is the triple drum sander, for the polishing and sandpapering of all kinds of woods, which has of late become famous for beautiful and

reliable production. It is the best mechanism of this type now in existence.

Two more Southern stacks will be in the producing column in a few weeks. The Southern Iron Co., of Nashville, Tenn., have secured control of the old Cumberland iron blast furnace in Dickson county, and will put it in operation in six of eight week. It will have one of the richest ore beds in the South. The new furnace at Covington, Va., is completed, and as soon as the railroad to the mines is finished will go into blast, probably in 60 days.

The Colorado Fuel & Iron Co., which is not in the steel rail association, is now turning out at Denver, Col., 400 tons of rails a day. It is now able to produce pig iron at $13 per ton, and markets its rails at prices ranging from $31 to $34 per ton. Its



F. W. WHEELER'S "CENTURION" STARTED.

Centurion is the name of the 100th vessel in the list of those built at the yards of F. W. Wheeler & Co. at West Bay City, Mich. Its keel was laid Thursday, March 2, Mr. Wheeler's 40th birthday. The double event was made memorable by the gathering together of a large party representing the lake shipping interests,and by a dinner after the ceremonies in the yards. The Centurion is to be a steel freight steamer and its name is given because of its ordinal position in the list of the Wheeler boats. Eight of the 100 are in sea-going service. The following are the Centurion's principal dimensions: Length over all, 378 feet 6 inches; length of keel, 360 feet; breath, extreme, 45 feet 2⅜ inches; breath, moulded, 45 feet; depth, moulded, 26 feet; depth of hold, 13 feet 2½ inches; height between decks, 9 feet 2 inches; height of forecastle, 7 feet 6 inches. All the material used in her construction is tested to stand a tensile strength of 60,000 pounds, with an elongation of 25 per cent. in 8 inches, and is of the best open hearth steel.

Another feature is that the shell plating butts will be overlapped instead of butt strapped, and riveted throughout with three complete rows of rivets. In riveting, steel rivets will be used, which will give greater sheering strength. All stringers and longitudinal butts will be treble riveted throughout, and the spar deck stringer is double butt-strapped, especial care being taken to insure both in shell and longitudinal ties a clear shift of butts of from two to three frame spaces. Two 20-inch hold stringers aside run her entire length, and an extra one is fitted in the fore hold, which will extend through the collision bulkhead and will be connected to the panting stringer, which will prove a factor of safety in case of meeting heavy ice. Her forefoot will be cutaway in ocean style to allow her to be quick on the helm.

The Centurion's motive power will consist of a modern triple expansion engine, built by F. W. Wheeler & Co in their own shops, with cylinders 23, 37½ and 63 inches, by 44 inches stroke, driving a Trout wheel of 13 feet 6 inches in diameter.

THE
AKRON BELTING CO.
MANUFACTURERS OF
No. 1 Oak-Tanned Leather Belting.
"Akron," "Eclipse" and "Dynamo" Brands.

"Akron" adapted for heavy drive belts; "Eclipse" especially adapted for small pulleys and high speed and mill rolls. Every belt guaranteed.

Also dealers in Rubber, Cotton and Gandy belting. **A 1 Raw Hide Lace - Leather,** Belt Fasteners, Belt Dressing, Cement, Elevator Buckets, Bolts and Mill Supplies generally.

WRITE FOR QUOTATIONS. AKRON, O.

Cleveland, O., Agency, J. W. PHILLPOTT, 15 Michigan St.

FUEL ECONOMY
SMOKE PREVENTION
IF YOU WANT TO KNOW ALL ABOUT
THE VERY BEST FURNACE IN THE
WORLD FOR ANY STEAM BOILER
Send for Illustrated Descriptive Pamphlet
ON MECHANICAL STOKERS FREE
THE BRIGHTMAN STOKER CO.
CLEVELAND OHIO.

WORTHINGTON
STEAM PUMPS
—AND—
CONDENSERS.
HENRY R. WORTHINGTON,
NEW YORK.
W. D. KEARFOTT, Sales Agent, 54 Frankfort St., CLEVELAND.

· STEEL CASTINGS ·
OPEN HEARTH AND CRUCIBLE
The Congdon Brake Shoe Co.
OFFICES AND FOUNDRIES: CHICAGO. ILL.
BRAKE SHOES

territorial position enables it to enter the market as a competitor of Eastern mills, and it has taken contracts totaling 60,000 tons for '93 deliveries. It is figured that the district tributary to these mills consumes 150,000 tons of steel rails per year.

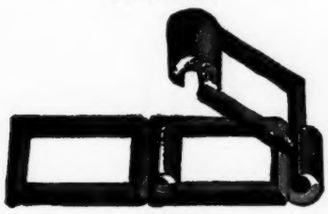
All departments of the Brown-Bonnell Iron Co., at Youngstown, are working to their full capacity. Work on the new mills is progressing slowly. It is the intention of the company to put a bar mill and 10-inch mill in place of the old mills, which they intend pulling down, and possibly they will make room for a sheet mill or a large plate mill.

The Springfield Steel Casting Foundry, at Springfield, O., has a Siemens-Martin open-hearth steel plant for the manufacture of all kinds of steel castings. This company is distinct from the Springfield Steel Casting Co., formerly of Springfield, which removed its plant, a few months ago, to Lima, O., and changed its name to the Lima Steel Casting Co. It also operates an open-hearth plant.

The statement prepared by Assignee H. K. Taylor, of the Youngstown (O.) Stamping Works, show assets as follows: Merchandise, $32,131.35; fixtures, $2,857.05; machinery, $13,413.97; real estate and buildings, $22,000; ledger accounts, $10,489.13; total, $80,892.50. Liabilities: Bills payable, $88,750; acceptances, $9,025.80; ledger accounts, $9,035.86; pay roll, $2,170.13; total, $110,981.79. It has been decided by the stockholders to continue the business, and to arrange with the creditors for a settlement.

LAKE SHORE IRON WORKS, MARQUETTE, MICH.,
Manufacturers of MINING MACHINERY.
HEAVY ROCK CRUSHERS FOR IRON ORE
A SPECIALTY.

JEFFREY
Chain Belting
—ALSO—
MALLEABLE, STEEL, WROUGHT AND SPECIAL CHAINS.



FOR
ELEVATING AND CONVEYING MACHINERY.
Send for 1893 catalogue and
REDUCED PRICE LIST.
THE JEFFREY MFG CO.,
143 E. First Ave., Columbus, O.
Chicago Branch, - - 48 So. Canal St.
New York Branch, 163 Washington St.

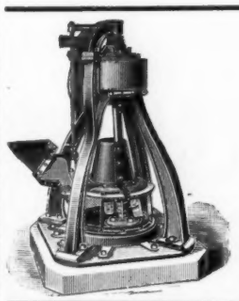
BERGER BROS.
MANUFACTURERS OF
Tinners' Hardware,
Berger's Celebrated Pail Ears, Saucepan Handles, Eave Trough Hangers, Pipe Fasteners, Hooks, Straps, Barrel Trucks, etc. Send for prices and catalogues.
237 Arch st. Philadelphia, Pa.

J. M. ALLEN, President.
WM. B. FRANKLIN, Vice-President.
F. B. ALLEN, Second Vice-President.
J. B. PIERCE, Secretary and Treas.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.
HARTFORD, CONN.

A. S. FERRY, General Agent, 208 Superior Street, Cleveland. O.
C. A. BURWELL, Chief Inspector, 208 Superior St., Cleveland O.
R. D. BRIGGS, Special Agent, 208 Superior St., Cleveland, O.
J. E. WOLCOTT, Special Agent, 81 4th Avenue, Pittsburgh, Pa.

CLEVELAND
GALVANIZING WORKS.
H. H. HODELL & CO.,
Galvanizing in all its branches, and Manufacturers of Rubber Buckets for chain pumps.
CLEVELAND, OHIO.

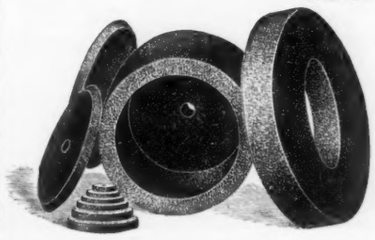


THE GRIFFIN MILL
A perfect pulverizer of all refractory substances by either the wet or dry process. It works better and at less expense than any other Mill, and is conceded to be the only perfect pulverizing Mill manufactured.
For **free** *illustrated pamphlet address*
BRADLEY FERTILIZER CO., 92 State St., Boston.

STEEL CASTINGS
MADE FROM THE BEST QUALITY OF
Crucible Steel.
CASTINGS guaranteed to be sound, solid and free from blowholes. Tensile strength and durability equal to any Steel Castings made.
F. E. ROBERTS FOUNDRY CO.,
Paulina St., South of Blue Island Ave.,
CHICAGO, ILL.

ROLLS. EST'B. AND 1863 PINIONS.
THE TOTTEN & HOGG IRON & STEEL FOUNDRY CO.
OFFICE & WORKS
24TH ST. & A.V.R.R.
PITTSBURGH, PA.
CHILLED & SAND ROLLS
ROCK CRUSHERS,
SHEARS SQUEEZERS AND ROLLING MILL MACHINERY.

THE SPRINGFIELD EMERY WHEEL CO.,
MANUFACTURERS OF
FOUR of the BEST
Formulæ of **EMERY WHEELS** and over **200** different varieties of Emery Wheel Machinery. All goods guaranteed satisfactory.
Catalogue furnished upon application.



The Springfield Emery Wheel Co.,
Bridgeport, Conn.
Western Agency, 120 So. Clinton St., Chicago, Ill.

MUNCIE, INDIANA

OFFERS THE FINEST FIELD FOR INVESTMENT TO BE FOUND IN THE WEST.

FACTORIES EMPLOYING 3,000 MEN

Have been located here within the past four months.

5,000 Additional Factory Hands will be Added within a Year.

The Population of the City, now 15,000. will be doubled within Two Years.

1000 NEW HOUSES ARE NEEDED NOW.

From 15 per cent. to 20 per cent. can be realized from rents, and the rents guaranteed by the manufactories. Fine residence lots for sale on reasonable terms. Call on or write,

THE MUNCIE LAND COMPANY,

MUNCIE, INDIANA.

ÆTNA IRON & STEEL CO.,

Bridgeport, - Ohio.

Manufacturers of BARS, ANGLES, TEES, CHANNELS and SPECIAL SHAPES, LIGHT SECTION RAILS, SHEET BARS and BILLETS. SHEETS and PLATES, PICKLED or PLAIN, COLD ROLLED and COMMON FINISH. ANNUAL CAPACITY, 50,000 TONS.

THE

Canadian Manufacturer,

TORONTO, - CANADA.

SEMI-MONTHLY. SUBSCRIPTION $1.00 PER YEAR.

The only Journal in Canada devoted to the Manufacturing Interests.

Reaches the Manufacturing Industries of the Dominion more thoroughly than any other.

Write for sample copy and advertising rates.

PLEASE MENTION THIS PAPER.

MACHINE BOLTS.

Hot Pressed Nuts, Wrought Iron

WASHERS

Highest Standard of Excellence.

Send for Prices.

MILTON MFG. CO., Milton, Pa.

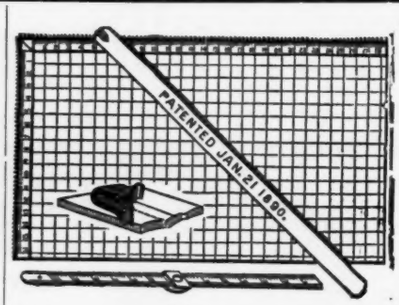
ENGINEERS

STUDY

MECHANICS

AT HOME.

Send for **FREE** circular to **The Correspondence School of Mechanics, Scranton, Pa.**



THE CANTON GLASS BOARD.

Cuts any Fraction of an Inch by Eights.

Unequaled for accuracy and quick work in cutting square or at any angle. Saves breakages, etc.

— ALSO —

IMPROVED TRAMMEL RULE for Cutting Circles

From 3 inches up to 48 inches, Segments, Gothic Shapes, etc.

SEND FOR CIRCULAR.

THE CANTON SAW CO., Canton. O.

LORD'S BOILER COMPOUND

is endorsed by the leading authorities throughout the world, adopted by the United States and Foreign Governments, is favorably mentioned in our standard treatises, relating to the use of steam, and is very highly recommended in more than thirty of these different works, costing from $1 to $10 per copy, and to prove this statement I will send one of these valuable books by mail, free of charge, with an order for the compound. For full information address

GEO. W. LORD, 316 Union Street, Philadelphia, Pa.

Or, THE EAGLE REFINING CO., Cleveland, O.

THE GRAVES PASSENGER AND FREIGHT.

ELEVATORS

THE GRAVES ELEVATOR CO.

ROCHESTER, N. Y.

NEW YORK, 92-94 LIBERTY ST. DETROIT, HODGES BUILDING.

BOSTON 53 STATE STREET.

2500 IN DAILY USE. CATALOGUE ON APPLICATION.

FOR SALE

In Florida,

Several thousand acres of the choicest orange and vegetable lands, including some of the most valuable muck beds and beautiful lakes in the States, all situated within three miles of railroad station.

THESE LANDS WILL BE SOLD

TO ACTUAL SETTLERS

At prices defying competition.

I have large tracts from 200 to 5,000 acres, grazing, farm, garden and orange lands, also several valuable phosphate beds near Dunnellon and Anthony, Marion County. Address

FRANK R. FIEDLER, BALTIMORE, MD.

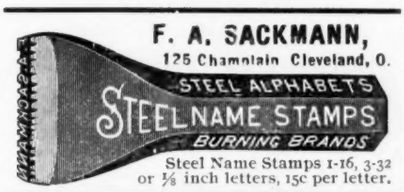
For Sale.

SECOND-HAND.

26-in. x 26-in x 6-ft. Wheeler Planer.
26-in x 14-ft. Dexter Lathe.
84-in. x 20-ft. Putnam Lathe, geared in face plate.
60-in. Niles Pulley Boring Machine, good as new.
14-in. Bement Slotter; heavy, powerful tool; cheap.
43-in. Boring Mill. 2 heads.
18-in. x 8-ft. Lodge-Barker Lathe.
20-in. x 20-ft. Empire Engine Lathe,
24-in. x 30-in. x 18-ft. New Haven Lathe.
60-in. Radial Drill; good as new; cheap.
14-in. Shaper; 2 tables.

PRENTISS TOOL & SUPPLY CO.,
59 S. Canal St., CHICAGO.
115 Liberty St., NEW YORK.

A. LEOFRED,
(Graduate of Laval and McGill,)
MINING ENGINEER.
Main Office: QUEBEC,
Branch Offices: { Sherbrooke; Montreal, 17 Placed'Armes Hill.
MINES, MINERAL PRODUCTS.



F. A. SACKMANN,
125 Champlain Cleveland, O.
Steel Name Stamps 1-16, 3-32 or ⅛ inch letters, 15c per letter.

STEEL CASTINGS.
Solid, Strong, Easily Machined.
New Castle Steel Casting Co.,
NEW CASTLE, PA.
CLEVELAND AGENTS:
THE J. H. McLAIN CO., No. 10 So. Water Street.

UNION
ELECTROTYPE
FOUNDRY
TELEPHONE 2129
829 SHERIFF ST. CLEVELAND O.

PERFORATED METALS

OF ALL KINDS FOR
MILLING MINING AND AGRICULTURAL MACHINERY,
PERFORATED IRON, STEEL, COPPER, BRASS, TIN, ZINC, LEAD, ETC., TO ORDER.
LARGE AND VARIED ASSORTMENT OF SIZES. CORRESPONDENCE SOLICITED.
THE ROBERT AITCHISON. PERFORATED METAL CO.,
OFFICE, ROOM 510 265 TO 269 DEARBORN STREET, CHICAGO, ILL. WORKS SOUTH CHICAGO.

Cleveland Stamping & Tool Co.

We press, cut, stamp and draw all kinds of sheet metal into all kinds of shapes, and make all kinds of

DIES and PRESSES.

Send us a sample or drawing of what you want stamped or blanked, or what you want to stamp or blank, and we will quote you prices on the article, or on the machinery to make it.

CLEVELAND, OHIO.

IRON CLAD PAINT CO.

actory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g,
CLEVELAND, OHIO.

Trade Mark Patented.

ORDER DIRECT FROM THE
Iron Clad Paint Co.
And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.

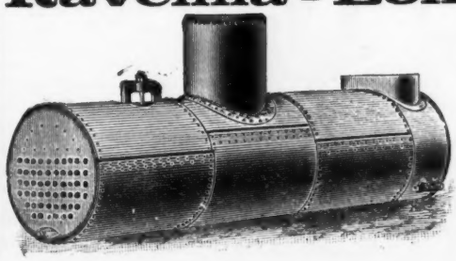
FURNISHED both Dry and Ground in Oil
USED BY NEARLY ALL THE RAILROADS.

AURORA TOOL WORKS,

AURORA, IND.
Successors to **E. A. SCHUMACHER,**
MANUFACTURERS OF
DRILL PRESSES

14" Sliding Head Bench Drill.
20" " " Plain with Patent Quick Return.
22" " " " " " " "
22" " " Back Geared with Patent Quick Return
24" " " Plain " " " "
24" " " Back Geared " " " "
24" " " Back Gear and Power Feed.
28" " " " " " " "
32" " " " " " " "
ENTIRELY NEW DESIGN AND IMPROVED.
40" Gibbed Sliding Head } with Patent Automatic Stop.
24" " " " }
Send for Catalogue and Prices.

Ravenna - Boiler - Works.



MANUFACTURERS OF ALL KINDS OF
Steam Boilers, TANKS,
Plate and Sheet Iron
Work of every description. Write for prices.
RAVENNA, - - OHIO.

HAVE YOU EXHAUST STEAM GOING TO WASTE?

Are your FEED WATER HEATERS obtaining the best results, in heating and purifying the feed water for your boilers? Are you heating your buildings with live steam or exhaust?

IF YOU DESIRE TO GET BETTER RESULTS from your present feed water heaters, and to heat your building by exhaust steam, without back pressure upon engines, saving power and water of condensation, together with **GREATER ECONOMY IN FUEL,** send for our catalogues of **Webster Vacuum Feed Water Heater and Purifier, and Williames Vacuum System of Steam Heating,** which contains some of the largest plants in the United States as references. We visit plants in any part of the United States, at our expense, furnish our apparatus, which may be attached to your present plant, upon trial, under guarantee.

Patentees, Proprietors and Manufacturers of the Webster Vacuum Feed Water Heater and Purifier.

SEND FOR CATALOGUE.

WARREN WEBSTER & CO., Managers and Sole Licensees for the Sale of Patent Rights in the United States.

Main Office and Works, 491 N. 3d St., PHILADELPHIA.

Where to Locate
NEW FACTORIES.

The Illinois Central Railroad Company is desirous of calling the attention of capitalists and manufacturers to the advantages possessed by the different cities and towns on their Southern Lines and on the lines of the Yazoo & Mississippi Valley Railroad Company in the shape of

UNLIMITED RAW MATERIAL
PROXIMITY TO MARKETS,
CHEAP LABOR,

Fuel, etc., and believes that it needs but a presentation of their merits to attract the careful attention of all interested in converting the raw materials to be found on their lines into finished product. Prominent among these are cotton, hard and soft wood, clay, fruits, vegetables, etc. A descriptive pamphlet of 150 pages, entitled "Where to Locate New Factories," has been issued by the Company, and a copy will be sent free on application to the undersigned, who will also give any further information as to

INDUCEMENTS OFFERED

by the different localities for desired industries. Individuals or companies wishing to embark capital in cotton, clay, wood-working, canning or other industries, can find a profitable field and hearty co-operation. For particulars address GEO. C. POWER, Industrial Commissioner I. C. R. R., 58 Michigan Avenue, Chicago.

N. A. HALDEMAN & CO.

59 North Second Street, PHILDELPHIA, PA.

MANUFACTURERS OF ALL KINDS OF

Steel and Iron Roofing, Roll Cap and Standing Seam, Corrugated Iron Roofing and Sidings, Iron Weather-Boards and V Crimp Roofing.

ROOFING AND SIDING OF MILLS, FACTORIES, ETC.. A SPECIALTY,

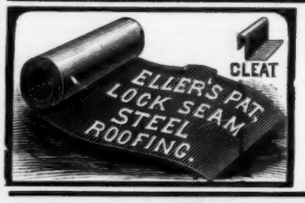
Our method of painting and applying our roofing makes it absolutely wind, water and lightning proof,

Before Placing Contracts write us for Estimate. When writing for Estimates Mention Price-List "7."

SYKES IMPROVED.

Best Roof on earth. Suitable for all buildings and very easily applied. All our iron and steel is re-rolled and box-annealed, and painted with the best of paint and pure linseed oil. We manufacture all styles of crimped, corrugated and beaded iron, etc., and make extremely low prices on carload lots. Write for prices and handsome catalogue, mentioning this paper.

SYKES IRON & STEEL ROOFING CO., Chicago, Ill., or Niles, Ohio.



STEEL ROOFING

Corrugated Iron, Beaded Iron Siding and Ceiling, Galvanized Steel Eave Trough, Conductor Pipe, Etc.

Write for Catalogue and Prices.

J. H. ELLER & CO.,

Address Office, No. 214 East Fifth Street, **Canton, O.**

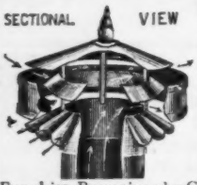
Niles Iron & Steel Roofing Co.

NILES. O.

BOTTOM PRICES ON ROOFING SIDING & CEILING

The "STAR VENTILATOR"

SECTIONAL VIEW



Galvanized Iron, Copper or Brass.

Down Draughts Prevented.

For Ventilating Mills, Factories, Foundries, Breweries, also Churches, Schoolhouses, Theatres—in fact all kinds of buildings, none equal the **"Star."**

A **cheap** Ventilator which will not do the work required, is **costly** at **any price**; our claim for **Superiority** of the "STAR" Ventilator is based on **Merit** only—believing the **first cost** to be a **secondary consideration.**

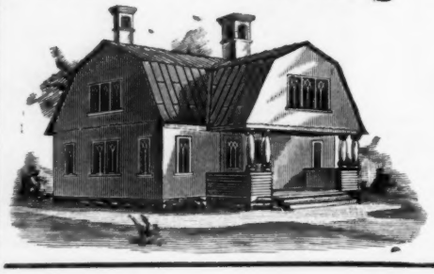
Send for a copy of our little book on Ventilation.

MERCHANT & CO.

Philadelphia. New York. Chicago. London.

Porter Iron Roofing & Corrugating Co.,

Cincinnati Ohio.



Manufacturers of all kinds of

IRON AND STEEL ROOFING AND SIDING.

The Pioneers of the Roofing Business in the United States. We guarantee satisfaction. We ship promptly. Give us a trial order and we will sell you more when in need of same.

☞ When writing for our Prices and Illustrated Catalogue, please mention *The Iron Trade Review.*

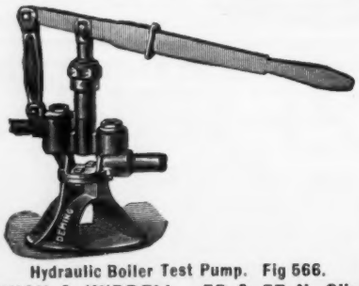
WILHELM & CO.,

Telegram Building, Rooms, 15, 16, 17 & 18,

HARRISBURG, PA.

Iron Ore, Pig Iron, Boiler Plates, Nails, Steel Rails, Coke, Bituminous Coal.

Western Union and Postal Telegraph wires in office
Cable Address, "WILHELM."



Hydraulic Boiler Test Pump. Fig 566.

THE DEMING CO.

SALEM, OHIO.

Pumps,

For HAND AND POWER.

Adapted for BOILER FEEDING, FIRE PURPOSES, etc.; also ARTESIAN WELL CYLINDERS and WORKING HEADS for FACTORIES, MILLS and FURNACES.

HENION & HUBBELL, 55 & 57 N. Clinton St., Chicago, Ill., General Western Agent.

Send for illustrated catalogue and price list. Mention this paper.

VERTICAL
- Balanced Compound Engines -

FOR

ROLLING MILLS AND BLAST FURNACES,

Direct Connections.

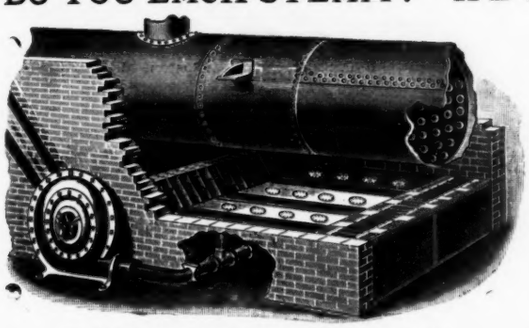
Any variations of speed desired. Guaranteed more economical, powerful and durable than any type of engine in use.

WELLS ENGINE CO.,
91 Liberty St., New York City.

FREE.

A very interesting and instructive pamphlet on lubrication by means of pure, flake graphite will be sent to all who desire it. It is scientific and practical.
J. S. DIXON CRUCIBLE CO., - Jersey City, N. J.

DO YOU LACK STEAM? WE CAN HELP YOU!



Gordon Hollow Blast Grate for Culm, Slack, Etc.

Sold only upon approval after trial.

For information, prices, or estimates,

ADDRESS

GORDON
Hollow Blast Grate Co.,
GREENVILLE, MICH.

W. A. McLAUGHLIN, MGR. A. H. BRAINARD, ASST. MGR

TELEPHONE 501

THE NATIONAL
PHOTO-ENGRAVING CO.

158 SUPERIOR ST.

CLEVELAND, O.

BEING IN THE BOILER BUSINESS,

MAKING STATIONARY TUBULAR BOILERS EXCLUSIVELY.

WE CAN MAKE A BETTER **BOILER** AND ALTHOUGH WE MAKE THEM OF

FLANGE STEEL WITH WELDLESS BRACES AND ECLIPSE MANHOLES

SELL THEM FOR LESS MONEY THAN OLD STYLE ONES.

WE FURNISH NEATER LITHOGRAPHS AND DETAIL ILLUSTRATIONS OF THIS CLASS OF BOILER THAN ANY FIRM IN THE UNITED STATES.

FULTON STEAM BOILER WORKS AND FOUNDRY, RICHMOND, IND.

STEEL CASTINGS

FROM 1-4 TO 15,000 POUNDS WEIGHT.

True to patterns, sound, solid, free from blow-holes and of great strength.
Stronger and more durable than iron forgings in any position, or for any service whatever.
60,000 CRANK SHAFTS and 50,000 GEAR WHEELS of this steel, now running, prove this.
Crossheads, Rockers, Piston-Heads, etc., for Locomotives, STEEL CASTINGS of every description.
Send for circulars and prices to

CHESTER STEEL CASTINGS CO.,
WORKS: CHESTER, PA. OFFICE: 407 LIBERTY STREET, - PHILADELPHIA, PA.

The Lawrence
Graphite Paint

gives perfect protection against acids, gases, brine, water, alkalies, smoke, moisture and sulphur fumes.

Invaluable for bridges, iron vessels, furnace cupolas, smoke stacks, iron roofs and buildings. Send for special circular.

W. W. LAWRENCE & CO
Pittsburg, Pa.

Cleveland Union Station.

Pennsylvania Lines.

Foot of Bank Street.

TICKET OFFICES at Station, Euclid Av., Woodland Av., and Weddell House corner.

THROUGH TRAINS RUN AS FOLLOWS BY CENTRAL TIME
* Daily. † Daily, except Sunday.

FROM CLEVELAND TO	LEAVE	ARRIVE
Pittsburgh and Bellaire	† 8.10 am	†12.30 pm
Pittsburgh, Bellaire and East	† 1.05 pm	† 6.10 pm
Philadelphia and New York	* 1.40 pm	*11.40 am
Baltimore and Washington	* 1.40 pm	*11.40 am
Alliance and Pittsburgh	* 1.40 pm	*11.40 am
Ravenna and Alliance	† 3.25 pm	†10.10 am
Hudson and Ravenna	† 5.10 pm	† 8.25 am
Philadelphia and New York	*11.10 pm	* 5.25 am
Baltimore and Washington	*11.10 pm	* 5.25 am
Alliance and Pittsburgh	*11.10 pm	* 5.25 am

Mt. Vernon and Pan-Handle Route.

FROM CLEVELAND TO	LEAVE	ARRIVE
Xenia and Cincinnati	* 8.00 am	* 5.25 pm
Akron and Columbus	* 8.00 am	* 5.25 pm
Akron and Columbus	† 1.05 pm	†12.30 pm
Akron and Orrville	† 3.25 pm	†10.10 am
Columbus and Cincinnati	* 8.00 pm	* 7.00 am

Valley Ry.

Depot foot of So. Water St.
City Office 218 Bank St.

	Arrive.	Depart.
Akron & Canton	*6:45 P M	*7:15 A M
Akron, Canton & Valley Jt	*10:30 A M	*3:15 P M
Valley Jt. & Way Stations	†6:45 P M	†7:15 A M
Akron, Canton & Chicago	*8:10 A M	*6:30 P M
Wooster	†2:40 P M	†6:30 P M
Akron, Canton & Marietta	†2:40 P M	†11:00 A M
Akron, Canton & Cambridge	†6:45 P M	†3:15 P M
Wheeling, Washington, D. C., and Baltimore	†2:40 PM	†3:15 P M
Steubenville, & Wheeling	††10:30PM †2:40PM	††11:00 A M †3:15 P M

†Daily except Sunday. *Daily. Pullman's Empire Style Drawing-Room Sleeping cars between Cleveland and Chicago.

Wheeling and Lake Erie Railway,

THE NEW THROUGH LINE

BETWEEN

TOLEDO

— AND —

Steubenville, Pittsburg, Marietta.

THROUGH COACHES

BETWEEN

Toledo & Marietta,

Through Sleepers Between

PITTSBURGH & CHICAGO

AND DAY COACHES BETWEEN

Toledo and Pittsburgh, Via Akron, Cuyahoga Falls, Kent, Ravenna, Leavittsburg, Warren, Niles, Girard, Youngstown, New Castle and Allegheny.

The Only Line running through

"BEAUTIFUL ZOAR."

A. G. BLAIR, Traffic Manager. JAS. M. HALL, Gen'l Pass. Agent.

BUYERS' DIRECTORY OF IRON AND STEEL TRADES.

Advertising Agencies—
G. P. Rowell & Co., New York.

Anti-Friction Metal—
Magnolia Anti-Friction Metal Co., New York.

Automatic Stokers.—
Brightman Stoker Co., Cleveland, O.

Anglers and Tees—
Aetna Iron & Steel Co., Bridgeport, O.

Beam Sawing Machines—
Higley Sawing and Drilling Machine Co. New York City.

Belting—
Akron Belting Co., Akron, O.

Bolts and Bolt Machinery—
Upson Nut Co., Cleveland.

Boilers and Boiler Attachments—
Babcock & Wilcox Co., New York.
Wm. B. Pollock & Co., Youngstown, O.
E. H. Jones & Co., Cleveland.
The Stirling Co., Pullman Bldg., Chicago, Ill.
Skinner Engine Co., Erie, Pa.
Chas. Miller, Beaver Falls, Pa.
Variety Iron Works, Cleveland.
Weston Engine Co., Painted Post, N. Y.
Ravenna Boiler Works, Ravenna, O.
The Golley & Finley Iron Works, Lima, O.
Brightman Stoker Co., Cleveland, O.
W. C. Leffel & Co., Springfield, O.
Aultman, Taylor Mfg. Co., Mansfield, O.
Liberty Engine Works, Cincinnati, O.
Fulton Steam Boiler Works and Foundry, Richmond, Ind.

Boiler Compound—
G. W. Lord, Philadelphia, Pa.

Blacksmith and Carriage Supplies—
Weber & Co., Cincinnati, O.

Blowers—
E. H. Jones & Co., Cleveland.
Brightman Stoker Co., Cleveland, O.
B. F. Sturtevant Co., Boston, Mass.

Barrows—
Akron Tool Co., Akron, O.
The Kilbourne & Jacobs Mfg. Co., Columbus, O.

Belt Elevators—
Lane & Bodley Co., Cincinnati, O.

Brick Machinery—
Straub Machinery Co., Cincinnati, O.

Bars—
Aetna Iron & Steel Co., Bridgeport, O.

Brake Shoes—
Congdon Brake Shoe Co., Chicago, Ill.

Cranes and Derricks—
Wm. Tod & Co., Youngstown, O.

Chain Belting—
Jeffrey Mfg. Co., Columbus, O.

Cupolas—
Victor Colliau, Detroit, Mich.
Greiner Economical Cupola Co., Chicago, Ill.
M. Steele Co., Springfield, Ill.

Cut-off Couplings—
J. H. & D. Lake Co., Hornellsville, N. Y.

Coal and Coke—
W. J. Rainey, Cleveland, O.
F. J. & H. R. Pool, Cleveland, O.

Correspondence School—
Correspondence School of Mechanics, Scranton, Pa.

Chilled and Sand Rolls—
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.

Consulting Engineers—
J. C. Slocum, Chicago, Ill.

Cupola Brick—
The S. Obermayer Co., Cincinnati, O.

Desks—
Cleveland Desk Co., Cleveland, O.

Dies—
Cleveland Stamping & Tool Co., Cleveland, O.

Drill Presses—
A. P. Quint, Hartford, Conn.
Aurora Tool Works, Aurora, Ind.
Hill, Clarke & Co., Chicago, Ill.
Callender & Patterson, Dayton, O.
Prentiss Tool & Supply Co., Chicago, Ill.

Drop Forgings—
The Whitman & Barnes Mfg. Co., Akron, O.

Drop Presses—
Toledo Tool & Machine Co., Toledo, O.
Godfrey J. Bremer, Kalamazoo, Mich.
Cleveland Stamping & Tool Co., Cleveland, O.

Dripping Machinery—
J. H. Day & Co., Cincinnati, O.

Dynamos for Electro-Plating—
Thos. Buchanan & Co., Cincinnati, O.

Ejectors—
James Jenks, Detroit, Mich.
American Injector Co.

Elevators—
Graves Elevator Co., Rochester, N. Y.

Emery Wheel Machinery—
J. Wendell Cole, M. E., Columbus, O., or Chicago, Ill.
Springfield Emery Wheel Co., Bridgeport, Ct.

Engines (Gas)—
Otto Gas Engine Co., Chicago, Ill.
Van Dusen Gas Engine Co., Cincinnati, O.

Emery and Corundum Wheels—
Acme Safety Emery Wheel Co., Detroit, Mich.
J. Wendell Cole, Columbus and Chicago.
Thos. Buchanan & Co., Cincinnati, O.
Springfield Emery Wheel Co., Bridgeport, Ct.

Electro and Nickel Platers' Supplies—
Thos. Buchanan & Co., Cincinnati, O.

Engravers and Electrotypers—
Eclipse Electrotype & Engraving Co., Cleveland.
Union Electrotype Foundry, Cleveland.

Engines (Steam)—
Wm. Tod & Co., Youngstown, O.
E. H. Jones & Co., Cleveland.
Skinner Engine Co., Erie, Pa.
Lane & Bodley Co., Cincinnati, O.
L. Spence & Son, Martins Ferry, O.
Weston Engine Co., Painted Post, N. Y.
Brightman Stoker Co., Cleveland, O.
W. C. Leffel & Co., Springfield, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
Liberty Engine Works, Cincinnati, O.
Wells Engine Co., New York City.

Engineers and Contractors—
E. H. Jones & Co., Cleveland.
Brightman Stoker Co., Cleveland, O.
J. C. Slocum, Chicago, Ill.
General Engineering Co., Harvey, Ill.

Electrical Engineers—
L. K. Comstock, Chicago Ill

Engineers' Specialties—
James Jenks, Detroit, Mich.

Eave Troughs and Conductors—
Berger Mfg. Co., Canton, O.

Emery Grinding and Polishing Machines—
Thos. Buchanan & Co., Cincinnati, O.

Explosives—
Hercules Powder Co., Cleveland.

Files, Makers of—
A. & H. Gough, Cleveland.
E. K. Morris & Co., Cincinnati, O.

Forges—
Cleveland City Forge & Iron Co., Cleveland.

For Sale—
L. Dreir, Brooklyn, N. Y.

Foundries—
Harn, Ow & Co., Beaver Falls, Pa.
Addyston Pipe & Steel Co., Cincinnati, O.
Radford Pipe and Foundry Co., Cincinnati, O.
Lane & Bodley Co., Cincinnati, O.
The Sam'l C. Tatum Co., Cincinnati, O.
J. W. Foley & Co., Cincinnati, O.
Brightman Stoker Co., Cleveland, O.
Congdon Brake Shoe Co., Chicago, Ill.
South Chicago Foundry Co., Chicago, Ill.
The Lloyd-Booth Co., Youngstown, O.
Totten & Hogg Iron and Steel Foundry Co. Pittsburg, Pa.
General Engineering Co., Harvey, Ill.
Waukegan Iron & Steel Casting Co., Chicago, Ill.

Fire Brick and Clay—
J. Downerd & Son Co., Zanesville, O.
J. V. Rose, Sharon, Pa.
Stowe Fuller & Co., Cleveland.
J. J. Shepard, Cleveland,
Union Mining Co., Mt. Savage, Md.
Garden City Sand Co., Chicago, Ill.
The S. Obermayer Co., Cincinnati, O.

Foundry Supplies—
J. Downerd & Co., Zanesville, O.
J. D. Smith Fdy. Supply Co., Cincinnati, O.
Straub Machinery Co., Cincinnati, O.
Garden City Sand Co., Chicago, Ill.
The S. Obermayer Co., Cincinnati, O.

Facings & Blackings—
J. D. Smith Fdy. Supply Co., Cincinnati, O.

Flour Mill Machinery—
The Bradford Mill Co., Cincinnati, O.

Furnace Linings—
Union Mining Co., Mt. Savage, Md.

Foot and Power Lathes—
H. L. Shepard, Cincinnati, O.
Sidney Machine Co., Sidney, O.

Fans—
B. F. Sturtevant Co., Boston, Mass.

Friction Clutch Pulleys—
J. H. & D. Lake Co., Hornellsville, N. Y.

Flue Cleaners—
E. Rayfield, Chicago, Ill.

Fuel Oil Burners—
Gilbert & Barker Mfg. Co. Springfield, Mass.
C. D. Juvinall & Co., Upper Sandusky, O.

Furnace Grates—
Gordon Hollow Blast Grate Co., Greenville, Mich.

Galvanizers—
H. H. Hodell, Cleveland.

Grindstones—
E. K. Morris & Co., Cincinnati, O.

Glass Boards—
Canton Saw Co., Canton, O.

Gearing
Straub Machinery Co., Cincinnati, O.

Graphite Paint—
Jos. Dixon Crucible Co., Jersey City, N. J.
W. W. Lawrence & Co., Pittsburgh, Pa.

Grate Bars—
Gordon Hollow Blast Grate Co., Greenville, Mich.

Higgs & Seaman's Gas Valves—
Totten & Hogg Iron and Steel Foundry Co., Pittsburgh, Pa.

Heaters and Purifiers—
Stilwell & Bierce Manufacturing Co., Dayton, O
E. H. Jones & Co., Cleveland.
Warren Webster & Co., Philadelphia, Pa.
Brightman Stoker Co., Cleveland, O.

Hack Saws—
Millers Falls Co., New York City.

Hardware Specialties—
The Sam'l C. Tatum Co., Cincinnati, O.

Heavy Hardware—
E. K. Morris & Co., Cincinnati, O.

Hangers, Pulleys and Shafting—
Lane & Bodley Co., Cincinnati, O.
The Sam'l C. Tatum Co., Cincinnati, O.
J. W. Foley & Co., Cincinnati, O.
Waukegan Iron & Steel Casting Co., Chicago, Ill.

Heating and Ventilating Fans—
B. F. Sturtevant Co., Boston, Mass.

Hydro-Carbon Burners—
C. D. Juvinall & Co., Upper Sandusky, O.

Iron Filler—
W. W. Lawrence & Co., Pittsburgh, Pa.

Iron Nails and Steel—
Weber & Co., Cincinnati, O.

Iron Ore, Bar and Pig Iron—
Oglebay, Norton & Co., Cleveland.
J. H. Outhwaite & Co., Cleveland.
Condit-Fuller Co., Cleveland.
E. C. Pope, Cleveland.
Cleveland Iron Mining Co., Cleveland.
Corrigan, Ives & Co., Cleveland.
Aetna Iron & Steel Co., Bridgeport, O.
B. M. Jones & Co., Boston and New York.
Wilhelm & Co., Harrisburg, Pa.

Iron Rolls and Pinions.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.

Injectors—
Penberthy Injector Co. Detroit Mich.
Eagle Lubricator Co., Cleveland, O.
American Injector Co.

Iron and Steel Roofing—
Sykes Iron & Steel Roofing Co., Niles, O.
Berger Mfg. Co., Canton, O.
Porter Iron Roofing & Corrugating Co., Cincinnati, O.
Niles Iron & Steel Roofing Co., Niles, O.
Curtis Steel Roofing Co., Niles, O.
J. H. Eller & Co., Canton, O.
N. A. Haldeman & Co., Philadelphia, Pa.

Iron and Steel Wire—
Trenton Iron Co., Trenton, N. J.

Investments—
Frank R. Biedler, Baltimore, Md.
Fidelity & Deposit Co., Baltimore, Md.
Duluth Mining Investment Co., Duluth, Minn.
Geo. Pemberton, New York.

Insurance Companies—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

Improvement Companies—
Muncie Land Co., Muncie, Ind.

Lathes—
Sidney Machine Co., Sidney, O.
H. L. Shepard, Cincinnati, O.
Aurora Tool Works, Aurora, Ind.
The Bradford Mill Co., Cincinnati, O.
Hill, Clarke & Co., Chicago, Ill.
Prentiss Tool & Supply Co., Chicago, Ill.

Link Belting—
The Jeffrey Mfg. Co., Columbus, O.

Lifting & Mixing Machinery—
J. H. Day & Co., Cincinnati, O.

Land Companies—
Muncie Land Co., Muncie, Ind.

Lanterns—
Rau Manufacturing Co., Chicago, Ill.

Lubricators—
Eagle Lubricator Co., Cleveland, O.
Lunkenheimer Brass Mfg. Co., Cincinnati, O.

Machinists' Tools and Supplies—
Aurora Tool Works, Aurora, Ind.
Cincinnati Milling Machine Co., Cincinnati, O.
Godfrey J. Bremer, Kalamazoo, Mich.
Hill, Clarke & Co., Chicago, Ill.
Callender & Patterson, Dayton, O.
Prentiss Tool & Supply Co., Chicago, Ill.

Machine Shops—
Toledo Machine & Tool Co., Toledo, O.
Spicer Mfg. Co., New Philadelphia, O.
Harn, Ow & Co., Beaver Falls, Pa.
Godfrey J. Bremer, Kalamazoo, Mich.
Waukegan Iron & Steel Casting Co., Chicago, Ill.

Moulding Sand—
Garden City Sand Co., Chicago, Ill.
J. Downerd & Son Co., Zanesville, O.
The S. Obermayer Co., Cincinnati, O.

Mining Machinery—
Copeland & Bacon, New York.
Lake Shore Iron Works, Marquette, Mich.

Metal Ceilings—
Fred F. Bischoff, Chicago, Ill.

Metal Sawing Machines—
Higley Sawing and Drilling Machine Co., New York City.

Municipal Bonds—
Frank R. Biedler, Baltimore, Md.

Milling Machines—
Cincinnati Milling Machine Co., Cincinnati.
Godfrey J. Bremer, Kalamazoo, Mich.
Brainard Milling Machine Co., Hyde Park, Mass.
Hill, Clarke & Co., Chicago, Ill.
Prentiss Tool & Supply Co., Chicago, Ill.

Mill Machinery—
Straub Machinery Co., Cincinnati, O.

Mines and Mining Stock—
Frank R. Biedler, Baltimore, Md.

Mining Engineers—
A. Leofred, Quebec, Can.

Mechanical Engineers—
J. C. Slocum, Chicago, Ill.

Office Furniture—
Cleveland Desk Co., Cleveland, O.

Oilers—
Rau Manufacturing Co., Chicago, Ill.

Oil Burners—
C. D. Juvinall & Co., Upper Sandusky, O.

Oil Grease Cups—
Lunkenheimer Brass Mfg. Co., Cincinnati, O.

Oil Well Machinery—
The Golley & Finley Iron Works, Lima, O.

Oil Tanks—
Aultman, Taylor Mfg. Co., Mansfield, O.

Ore Crushers—
Bradley Fertilizer Co., Boston, Mass.
Totten & Hogg Iron and Steel Foundry Co., Pittsburgh, Pa.
Lake Shore Iron Works, Marquette, Mich.

Pumps (Steam)—
E. H. Jones & Co., Cleveland.
Deming Co., Salem, O.
Brightman Stoker Co., Cleveland, O.
Henry R. Worthington, New York City.

Paint—
Iron Clad Paint Co., Cleveland.
W. W. Lawrence & Co., Pittsburg, Pa.
Jos. Dixon Crucible Co., Jersey City, N. J.

Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago, Ill.
Aitchison Perforated Metal Co., Chicago.

Photo-Engravers—
National Photo-Engraving Co., Cleveland.

Powder—
Hercules Powder Co., Cleveland.

Presses—
Toledo Machine and Tool Co., Toledo, O.
Godfrey J. Bremer, Kalamazoo, Mich.
Cleveland Stamping & Tool Co., Cleveland, O.

Planers—
Prentiss Tool & Supply Co., Chicago, Ill.

Plumbago—
J. D. Smith Fdy. Supply Co., Cincinnati, O.
The S. Obermayer Co., Cincinnoti, O.

Pulleys—
Straub Machinery Co., Cincinnati, O.
Lane & Bodley Co., Cincinnati, O.
J. W. Foley & Co., Cincinnati, O.

Power Plants—
Weston Engine Co., Painted Post, N. Y.

Portable Forges—
B. F. Sturtevant Co., Boston, Mass.

Plates—
Aetna Iron & Steel Co., Pridgeport, O.

Pulverizing Machinery—
Bradley Fertilizer Co., Boston, Mass.

Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland.

Radial Drills—
Universal Radial Drill Co., Cincinnati, O.

Rock Breakers—
Totten & Hogg Iron and Steel Foundry Co., Pittsburgh, Pa.
Bradley Fertilizer Co., Boston, Mass.
Lake Shore Iron Works, Marquette, Mich.

Rolling Mill Machinery—
The Lloyd-Booth Co., Youngstown, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
General Engineering Co., Harvey, Ill.

Roll Lathes—
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.

Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

Saws—
Peter Gerlach & Co., Cleveland.
Canton Saw Co., Canton, O.

Second-Hand Machinery—
Prentiss Tool & Supply Co., Chicago, Ill.

Smokeless Furnaces—
J.V.Burke, Chicago, Ill.
Brightman Stoker Co., Cleveland, O.

Steel Rails, Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland.

Sheet Iron—
Cleveland Rolling Mill Co., Cleveland.
The Golley & Finley Iron Works, Lima, O.
Aetna Iron & Steel Co., Bridgeport, O.
Ravenna Boiler Works, Ravenna, O.

Semi-Steel—
South Chicago Foundry Co., Chicago, Ill.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.

Sheet Steel—
Aetna Iron & Steel Co., Bridgeport, O.

Steel Stamps and Stencils—
J. H. Fleharty & Co., Cleveland.
F. A. Sackman, Cleveland, O.

Steel Color Paint—
W. W. Lawrence & Co., Pittsburgh, Pa.

Steel Castings—
Chester Steel Casting Co., Philadelphia, Pa.
New Castle Steel Casting Co., New Castle, Pa.
Congdon Brake Shoe Co., Chicago, Ill.
South Chicago Foundry Co., Chicago, Ill.
Totten & Hogg Iron and Steel Foundry Co., Pittsburgh, Pa.
F. E. Roberts Foundry Co., Chicago, Ill.

Scrap Iron & Steel—
Klein & Cohn, Cincinnati, O.

Special Machinery—
Toledo Machine & Tool Co., Toledo, O.
J. H. Day & Co., Cincinnati, O.
Godfrey J. Bremer, Kalamazoo, Mich.
General Engineering Co., Harvey, Ill.
Cleveland Stamping & Tool Co., Cleveland, O.

Shafting—
Straub Machinery Co., Cincinnati, O.

Stokers—
Brightman Stoker Co., Cleveland, O.

Steel Rails, Blooms and Billets—
Aetna Iron & Steel Co., Bridgeport, O.

Sand and Chill Rolls—
The Lloyd-Booth Co., Youngstown, O.

Smoke Consumer—
The Breckett Smoke Consuming Co., Norwalk, O.
Northwestern Land & Coal Co., Boston, Mass.
Brightman Stoker Co., Cleveland, O.

Steel Mushet's—
B. M. Jones & Co., Boston and New York.

Stay Bolt Iron—Taylor's—
B. M. Jones & Co., Boston and New York.

Twist Drills—
Cleveland Twist Drill Co., Cleveland.
The Whitman & Barnes Mfg. Co., Akron, O.

Torches—
Rau Manufacturing Co., Chicago, Ill.

Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland.

Tanks—
The Golley & Finley Iron Works, Lima, O.

Tin Plates (Roofing)—
Merchant & Co., Philadelphia, Pa.

Tinners' Hardware—
Berger Bros, Philadelphia, Pa.

Tinning Machinery—
The Lloyd-Booth Co., Youngstown, O.

Tramways—
Trenton Iron Co., Trenton, N. J.

Trucks—
The Spicer Mfg. Co., New Philadelphia, O.

Turret Drills—
A. P. Quint, Hartford, Conn.

Ventilating Fans—
E. H. Jones & Co., Cleveland.
Brightman Stoker Co., Cleveland, O.
B. F. Sturtevant Co., Boston, Mass.

Valves—
Lunkenheimer Brass Mfg. Co., Cincinnati, O.

Watchman's Time Detector.
Cleveland Electrical Mfg. Co., Cleveland, O.
A. Nanz & Co., New York City.

Wood-Working Machinery—
J. A. Fay & Egan Co., Cincinnati, O.

Wire Machinery—
John Adt & Son, New Haven, Conn.

Washers—
Milton Mfg. Co., Milton, Pa.

Water, Gas and Steam Pipe—
Addyston Pipe & Steel Co., Cincinnati, O.
Radford Pipe & Foundry Co., Cincinnati, O.

Wheelbarrows—
Akron Tool Co., Akron, O.

Wire Rope—
Trenton Iron Co., Trenton, N. J.

Water Stand Pipes—
Aultman, Taylor Mfg. Co., Mansfield, O.

THE
CLEVELAND-CLIFFS IRON CO.,
Cleveland Iron Mining Co.—Iron Cliffs Co.
Producers and Sellers
Lake Superior Iron Ores and Pioneer Charcoal Pig Iron.
Mercantile Building, - CLEVELAND, O.

Oglebay, Norton & Co.,
Successors to Tuttle, Oglebay & Co.,
Commission Dealers in
IRON ORES,
FROM MARQUETTE, GOGEBIC AND MENOMINEE DISTRICTS.
CLEVELAND, OHIO.

J. H. OUTHWAITE. W. G. POLLOCK.
J. H. OUTHWAITE & CO.,
Exclusive attention given to
LAKE SUPERIOR AND MENOMINEE RANGE
IRON ORE.
Perry-Payne B'ld'g, - Cleveland, O.

CORRIGAN, IVES & CO.,
DEALERS IN
IRON ORE AND PIG IRON,
Rooms 716, 717, 718, 719 Perry-Payne Bld'g,
CLEVELAND, OHIO.

THE CONDIT-FULLER CO.,
Pig and Bar Iron,
CLEVELAND, . OHIO.

E. C. POPE,
COMMISSION DEALER IN
Iron Ore, Pig Iron
AND METALS.
Cleveland, - Ohio.

CLEVELAND ROLLING MILL CO.,
CLEVELAND, - OHIO.
—MANUFACTURERS OF—
BESSEMER AND OPEN-HEARTH STEEL,
Ingots, Billets, and Slabs. Steel Rails, Steel Beams, Channels and Angles. Steel Forgings, Bar Spring, and Sleigh Shoe Steel. Steel Wire of all kinds. Barbed Wire, Iron and Steel Plates. Galvanized and Black Sheet Iron and Steel Corrugated Iron Roofing.

THE AERATED FUEL COMPANY'S SYSTEM

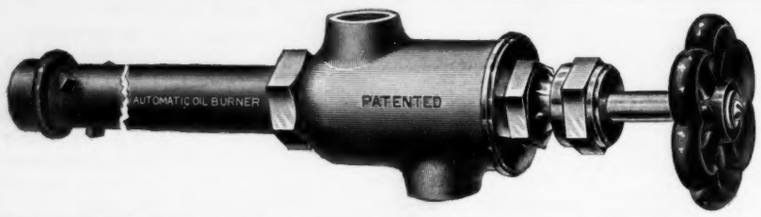
Gives the best oil fire. Does not increase insurance. **200** Plants in use for 50 varieties of work. Forging and tempering a specialty. Send for Catalogue to Hall Steam Pump Co., Pittsburg. **GILBERT & BARKER MFG. CO., General Agents for the U. S., Springfield, Mass.**

JUVINALL'S

Automatic Fuel Oil

BURNER.

References, prices, &c., furnished on application.



FOR General Work, Generating Steam, Burning Lime &c., wherever Crude Oil is used for fuel. Can be set to hold any desired pressure of steam, and needs no further attention. *Strictly Automatic.*

For further particulars address,

C. D. JUVINALL & CO.,
Upper Sandusky, Ohio.

Alphabetical List of Advertisers.

The star (*) indicates that the adv. appears alternate weeks; the dagger (†) once a month; the double dagger (‡) once in three weeks; the parallel (‖) three times out of four.

	PAGE
Aitchison, Rob't Perforated Metal Co	21
Adt, John & Son	22
Acme Safety Emery Wheel Co	1
Akron Belting Co	18
Akron Tool Co., The	31
Aurora Tool Co	21
Aultman Taylor Mfg. Co	16
Aetna Iron & Steel Co	20
American Injector Co	2
Bischoff, F. F. & Co	32
Babcock & Wilcox Co	32
Berger Bros	19
Bradley Fertilizer Co	19
Brightman Stoker Co	18
*Berger Mfg. Co	—
†J. V. Burke	—
Biedler, Frank R	21–29
Bremer, Godfrey J	31
*Beckett Smoke Consuming Co	—
Callender & Patterson	31
Canadian Manufacturer	20
*Chicago, Milwaukee & St. Paul Railway Co	—
*Cleveland Desk Co	—
*Cleveland Electrical M'f'g. Co	31
Cleveland City Forge & Iron Co	1
Cleveland Twist Drill Co	32
Cleveland Iron Mining Co	25
Cleveland Stamping & Tool Co	21
Cleveland Rolling Mill Co	25
Condit Fuller Co	25
*Copeland & Bacon	—
Colliau, Victor	30
Cole, J. Wendell	32
Chester Steel Casting Co	23
Corrigan, Ives & Co	25
Canton Saw Co., The	20
*Cincinnati Milling Machine Co	32
Comstock, L. K	31
Congdon Brake Shoe Co	18
Correspondence School of Mechanics	20
*Curtis Steel Roofing Co	—
Deming Co	22
Downerd & Son Co., The J	31
Dixon, Jos. Crucible Co	23
Dreier, T	29
Fay & Egan Co., J. A	27
Eclipse Electrotype & Engraving Co	32
*Eagle Lubricator Co	31
Eller & Co., J. H	22
Fleharty, J. H. & Co	30
Fulton Steam Boiler Works & Foundry	23
Garden City Sand Co	16
General Engineering Co	17
Graves Elevator Co	20
Gerlach, Peter & Co	26
Greiner Economical Cupalo Co	29
*Golley & Finley Iron Works	—
Gilbert & Barker Mfg. Co	26
Gordon Hollow Blast Grate Co	23
Haldeman & Co., N. A	19
Harrington & King Perforating Co	30
Hill, Clarke Co	28
†Higley Sawing & Drilling Machine Co	—
*Hodell, H. H. & Co	19
Hartford Steam Boiler Insp. & Ins. Co	19
Hercules Powder Co	28
*Illinois Central R. R	22
Iron Clad Paint Co	21
Industry File Works	32
Jones & Co., B. M	2
Jones, E. H. & Co	32
Jeffrey Mfg. Co	19
Jenks, James	30
Juvinall & Co., C. D	26
Kilbourne & Jacobs Mfg. Co., The	2
Lake Shore Iron Works	19
*Leffel Co., W. C	—
*Lake Co., J. H. & D	—
Leofred, A	21
Lloyd Booth Co	27
Lord, G. W	20
Lawrence & Co., W. W	23
*Lunkenheimer Co., The	—
Milton Mfg. Co	20
Magnolia Anti-Friction Metal Co	1
†Millers Falls Co	—
Muncie Land Co	20
*Merchant & Co	22
National Photo-Engraving Co	23
*Nanz & Co., A	—
New Castle Steel Castings Co	21
*Niles Iron & Steel Roofing Co	22
*Northwestern Land & Coal Co	—
Obermayer Co., The S	1
Outhwaite, J. H. & Co	25
Oglebay, Norton & Co	25
Otto Gas Engine Co	30
Pemberton, Geo	30
Pope, E. C	25
Penberthy Injector Co	32
Pollock, Wm. B. & Co	2
Porter Iron Roofing & Corrugating Co	22
Poole, F. J. & H. R	1
Prentiss Tool & Supply Co	21
Quint, A. P	31
Ravenna Boiler Works	21
Rau Manufacturing Co	28
†Rayfield, E	—
Rainey, W. J	2
Roberts Foundry Co., F. E	19
Sykes Iron Roofing Co	22
Sackman, F. A	21
Stirling Co	31
Stilwell & Bierce Mfg. Co	2
Shepard, H. L., Agent	32
Skinner Engine Co	30
*Steele Co., The M	—
‖Sharon Fire Brick Works	1
‖Stowe Fuller & Co	1
*Spicer Mfg. Co., The	28
L. Spence & Son	2
‖J. J. Shepard	32
Sidney Machine Co	32
Springfield Emery Wheel Co	19
South Chicago Foundry Co	16
Sturtevant B. F. Co	27
Slocum, J. C	1
Toledo Machine & Tool Co	27
Tod, Wm. & Co	30
Totten & Hogg Iron and Steel Co	19
*Trenton Iron Co	—
Upson Nut Co	30
Union Electrotype Foundry	21
Union Mining Co	17
*Variety Iron Works	31
Van Duzen Gas Engine Co	2
*Warren Webster & Co	22
Waukegan Iron & Steel Casting Co	17
Wells Engine Co	23
Weston Engine Co	1
Whitman & Barnes Mfg. Co	17
*Wilhelm & Co	22
Worthington, Henry R	18

THE

IRON TRADE REVIEW

Pays Special Attention to

Iron Ore, Blast Furnace, Rolling Mill, Foundry and Machine Shop Interests.

PER YEAR $3.00.

ESTABLISHED 1854.

PETER GERLACH & CO.,

MAKERS OF

Saws, Tools and Machinery.

Office and Warerooms, 28 Columbus St.

Factories on Columbus, Winter and Leonard Sts

Cleveland, Ohio, U. S. A.

FOR
ARTISTIC
PRINTING
WRITE
THE
CLEVELAND
PRINTING &
PUBLISHING CO.,
CLEVELAND, O.

IRON AND STEEL MARKETS.

IRON ORE.

[On Lake Erie docks.]

Extra Low Phosphorus Bessemer	$ 5.00
No. 1 Specular, Bessemer	$4.50@$4.75
No. 1 Bessemer hematite	$3.85@$4.25
Hematites No. 1 non-Bessemer	$3.25
No 1. Specular, Non-Bessemer	$3.75@$4.15

PIG IRON.

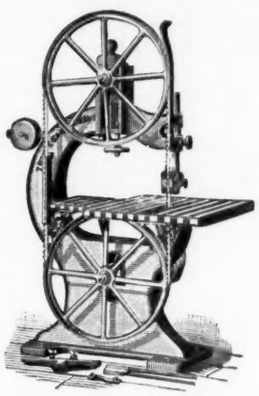
CLEVELAND (f. o. b. cars):	
Bessemer	$13 50@$13 75
No. 1 Strong Foundry	14 25@ 14 50
No. 2 Strong Foundry	13 25@ 13 50
No. 1 Grey Forge, red short	12 35@ 12 50
No. 2 Gray Forge, neutral	12 25@ 00 00
No. 1 American Scotch	14 50@ 00 00
No. 2 American Scotch	13 50@ 00 00
Lake Superior Charcoal	17 00
PITTSBURGH (reported by A. H. Childs):	
No. 1 Foundry	$14 00@$14 25
No. 2 Foundry	13 00@ 13 25
Grey Forge	12 25@ 12 50
White and Mottled	11 50@ 11 75
Warm Blast Charcoal	18 00@ 22 00
Cold Blast Charcoal	2200@ 27 00
Bessemer	13 40@ 13 75
CHICAGO (reported by our representative:)	
Lake Superior Charcoal	$16 50@$17 00
Local Coke Foundry No. 1	13 50@ 14 00
Local Coke Foundry No. 2	13 00@ 13 50
Local Coke Foundry No. 3	13 00@ 13 25
Local Scotch Foundry No. 1	14 00@ 15 00
Local Scotch Foundry No. 2	13 50@ 14 00
Local Scotch Foundry No. 3	13 00@ 13 50
Southern Coke No. 1	14 85@ 15 00
Southern Coke No. 2	13 35@ 13 60
Southern Coke No. 3	12 85@ 13 10
Southern No. 1 Soft	13 35@ 13 60
Southern No. 2 Soft	12 85@ 13 10
Ohio Silveries No. 1	16 50@ 17 00
Ohio Silveries No. 2	16 25@ 16 75
Ohio Strong Softeners No. 1	16 50@ 17 00
Ohio Strong Softeners No. 2	15 50@ 16 00
Tennessee Charcoal	16 50@ 17 00
Alabama Car Wheel	18 85@ 19 85
CINCINNATI (reported by Hyatt, Mathews & Co.):	
Southern Coke No. 1, Foundry	$13 25@$13 50
Southern Coke No. 2 and No. 1 Soft	12 25@ 12 50
Southern Coke No. 3	11 75@ 12 00
Ohio Soft Stone Coal No. 1	16 00@ 16 50
Mahoning Valley No. 1	15 50@ 16 00
Mahoning Valley No. 2	14 50@ 15 00
Hanging Rock Charcoal No. 1, Fdy	18 25@ 18 50
Hanging Rock Charcoal No. 2, Fdy	17 25@ 17 50
Alabama Charcoal No. 1	16 00@ 16 50
Standard Southern Coke, Grey Forge	11 00@ 11 25
Mottled Neutral Coke	10 75@ 11 00
High Grade Virginia Coke Iron No. 1	16 00@ 16 25
High Grade Virginia Coke Iron No. 2	15 00@ 15 25
Southern Car Wheel Iron	17 00@ 17 50
Lake Superior Car Wheel & Malleable	17 50@ 18 00
BUFFALO (reported by Rogers, Brown & Co.)	
Mahoning and Shenango Valley, strong, No. 1 Foundry	$14 50
Mahoning and Shenango Valley, strong, No. 2 Foundry	13 75
Ohio Softener No. 1	14 50
Ohio Softener No. 2	14 00
Jackson Co. Silvery, No. 1	$17 00@ 17 30
Jackson Co. Silvery No. 2	16 30@ 16 80
Lake Superior Charcoal	17 25
Tennessee Charcoal	18 00
Southern Softener No. 1	14 00
Alabama Car Wheel	19 00
Hanging Rock Charcoal	20 50
LOUISVILLE (reported by Hall Bros. & Co.):	
Southern Coke No. 1	$13 50@$13 75
Southern Coke No. 2	12 50@ 12 75
Southern Coke No. 3	12 00@ 12 25
Southern Charcoal No. 1	16 00@ 17 00
Southern Charcoal No. 2	15 50@ 16 00
Missouri Charcoal No. 1	17 00@ 17 50
Missouri Charcoal No. 2	16 50@ 17 00
Neutral Coke	11 50@ 12 00
Mottled	11 00@ 11 25
Southern (standard brands)	20 00@ 21 00
Southern (other brands)	18 50@ 19 50
Lake Superior	19 50@ 20 50
ST. LOUIS (reported by Rogers, Brown & Meacham):	
Southern Coke No 1	$13 75@$14 00
Southern Coke No. 2	12 50@ 12 75
Southern Coke No. 3	12 25@ 12 50
Southern Grey Forge	11 50@ 11 75
Southern Charcoal No. 1	15 50@ 16 00
Missouri Charcoal No. 1	14 00@ 14 50
Ohio Softeners	16 50@ 17 00
Lake Superior	17 50@ 18 00
Southern	18 25@ 18 50
Connellsville Coke, St. Louis	5 65

Pattern and Flask Makers'

MACHINERY, ETC.

One of our leading specialties.

ORIGINATORS.
INTRODUCERS.
CONSTRUCTORS.



BAND SAWS-Five Sizes.

All fitted with our new Roller Guide, which prevents the blades from breaking, etc.

Wood Working Machinery

FOR ANY PURPOSE.

LARGEST LINE IN THE U. S.

Catalogue Now Ready.

Nearly 300 pages and Machines.

J. A. FAY & EGAN CO.

Nos. 251 to 271 W. Front St., CINCINNATI, OHIO.

THE STURTEVANT STEEL PRESSURE BLOWERS

For Cupola Furnaces and Forges.

THE STURTEVANT SYSTEM.
—OF—
Heating and Ventilating Manufacturing Establishments

PORTABLE FORGES.

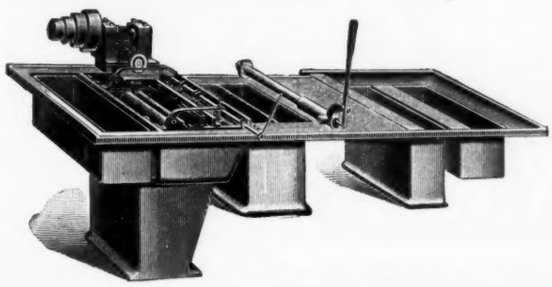
Send for Catalogue.

B. F. STURTEVANT CO.,
Boston, Mass.

Branches: 91 Liberty St., New York. 16 So. Canal St., Chicago.
135 No. Third St., Philadelphia.

THE LLOYD-BOOTH CO., YOUNGSTOWN, OHIO.

Tinning MACHINERY.



Rolling Mills, Sand and Chill ROLLS.

No. 25 Press.

THE TOLEDO MACHINE TOOL CO.,

MANUFACTURERS OF

Presses, Dies and Special Machinery,

FOR BAR AND SHEET METALS. DIES FOR ALL KINDS OF WORK.

Mention this paper. SEND FOR ILLUSTRATED CIRCULARS.

Oak and Superior Sts., TOLEDO, OHIO.

DETROIT (reported by William F. Jarvis & Co.:)

Lake Superior Charcoal, all numbers	$16 50@$17 00
Lake Superior (coke) Bessemer	15 00@ 15 50
Lake Superior Coke, Foundry, all ore	15 50@ 16 00
Standard Ohio Black Band	15 50@ 16 00
Southern No. 1	14 00@ 14 50
Southern Grey Forge	12 50@ 13 00
Jackson County (Ohio) Silvery	17 25@ 17 75

LOUISVILLE (reported by Geo. H. Hull & Co.)

Southern Coke No. 1 Foundry	$13 00@$13 25
Southern Coke No. 2 Foundry	12 00@ 12 25
Southern Coke No. 3 Foundry	11 00@ 11 25
Grey Forge	10 75@ 11 00
Southern Charcoal No. 1 Foundry	15 00@ 16 00
Car Wheel	17 50@ 17 75

OLD RAILS AND SCRAP METAL.

[Prices paid by mills.]

	Gross Tons
Old iron rails	$19 00
Old steel rails	14 00
	Net Tons
No. 1 R. R. wrought scrap	$15 00
No. 1 wrought scrap	14 50
No. 1 Machine cast scrap	11 00
Iron axles	20 50
Axle turnings	11 75
Wrought turnings (free from cast)	9 50
Cast borings	6 75
Uncut wrought iron boilers	8 50
Steel boiler Plates	12 00
Grate bars	7 00
Pipes and flues (clean)	10 00
Tank iron	9 50
Hoop and band iron	8 00
Sheet iron	7 00
Wrought drillings	8 50
Malleable iron	9 00

STRUCTURAL MATERIAL.

Beams and Channels (f. o. b. mill)	1.90c@2.00c
Angles	1.70c@1.80c
Tees	2.30c
Universal Plates	1.70c
Sheared Plates	1.80c

MERCHANT IRON AND STEEL.

Flat Bar.

1½ to 4 by ⅜ to 1 inch	1 65
4¼ to 6 by ⅜ to 1 inch	1 70
1¾ to 6 by 1⅛ to 2 inch	1 85
1¼ & 1⅜ by ⅜ to ¾ inch	1 70
1 & 1⅛ by ⅜ to ¾ inch	1 75
⅝, ⅞, ⅞, by ⅜ to ⅝ inch	1 85

Round and Square.

1 to 1⅞ inch	1 65
2 to 2⅝ inch	1 75
2¾ to 3¼ inch	1 90
3⅜ to 4 inch	2 15
4¼ to 4½ inch	2 75
4¾ to 5 inch	3 00

Oval.

⅞ to 1¼ inch	1 85
⅝ to ¾ inch	1 85
½	2 05
⅜	2 25

Half Oval and Half Round.

1½ to 3 inch	2 20
⅞ to 1½ inch	2 00
⅝ to ¾ inch	2 25
½	2 40
⅜	3 50

Heavy Band.

1¼ to 6 by ¼ and 5-16 inch	1 75
1 to 1⅜ by ¼ and 5-16 inch	1 80
¾ to ⅞ by ¼ and 5-16 inch	1 90
½ to ⅝ by ¼ and 5-16 inch	2 15

Hoops.

1¼ to 4, Nos. 13 to 15	2 40
1¼ to 2, Nos. 16 to 18	2 45
1¼ to 2, No. 19	2 50
1¼ to 2, No. 20	2 50
1¼ to 2, No. 21	2 60
1¼ to 2, No. 22	2 70
15-16, 1 and 1⅛, Nos. 13 to 15	2 45
15-16, 1 and 1⅛, Nos. 16 to 18	2 50
15-16, 1 and 1⅛, Nos, 19 and 20	2 60
15-16, 1 and 1⅛, No, 21	2 70
15-16, 1 and 1⅛, No. 22	2 80
⅞, Nos. 13 to 15	2 60
⅞, Nos. 16 to 18	2 70
⅞, Nos. 19 and 20	2 80
⅞, No. 21	2 90
⅞, No. 22	3 00
13-16, Nos. 13 to 15	2 70
13-16, Nos. 16 to 18	2 80
13-16, Nos. 19 and 20	2 90
13-16 No. 21	3 00
13-16, No. 22	3 10
¾, Nos, 13 to 15	2 80
¾, Nos. 16 to 18	2 95
¾, Nos. 19 and 20	3 05
¾, No. 21	3 15
¾, No. 22	3 25
11-16, Nos. 13 to 15	3 05
11-16, Nos 16 to 18	3 10
11-16, Nos. 19 and 22	3 20
11-16, No. 21	3 30
11-16, No. 22	3 40
⅝, Nos. 13 to 15	3 10
⅝, Nos. 16 to 18	3 20
⅝, Nos. 19 and 20	3 30
⅝, No. 21	3 40
⅝, No. 22	3 50
⅝, No. 23	3 60

Light Band.

1½ to 6 by ⅛ to 3-16 inch	1 95
1½ to 6 by Nos. 11 and 12	2 00
1 to 1⅜ by ⅛ to 3-16 inch	2 00
1 to 1⅜ by Nos. 11 and 12	2 05
⅞ and 13-16 by ⅛ to 3-16 inch	2 15
⅞ and 13-16 by Nos. 11 and 12	2 20

Brainard Milling Machine Co.

WORKS AT HYDE PARK, MASS.

Eleven Sizes of Universal MILLING MACHINES.

Six Sizes of Upright and Horizontal Plain MILLING MACHINES.

Four Sizes of GEAR-CUTTING MACHINES.

New Invention in Cam Cutting Machinery.

HILL, CLARKE & CO., Selling Agts.,

BOSTON, MASS. 156 Oliver Street.

CHICAGO, ILL. 14 South Canal St.

RAU M'F'G. CO.,

MANUFACTURERS OF

Copper, Brass and Tin Oilers,

Of all Descriptions, also

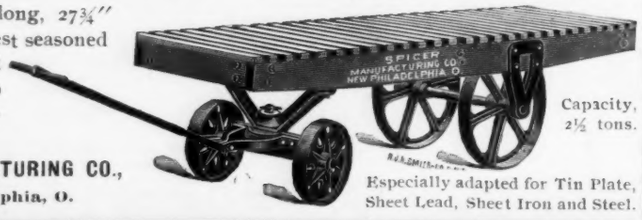
Torches, - - Lanterns, Etc.

128 Michigan St., CHICAGO, ILL.

SPICER SHEET METAL TRUCK.

Platform, 90″ long, 27¾″ wide; made of best seasoned hickory, with slat top. Weight, 350 pounds. For particulars address

SPICER MANUFACTURING CO., New Philadelphia, O.



Capacity, 2½ tons.

Especially adapted for Tin Plate, Sheet Lead, Sheet Iron and Steel.

HERCULES POWDER

HERCULES, THE GREAT STUMP AND ROCK ANNIHILATOR.

SEND FOR DESCRIPTIVE PAMPHLET.

Stump before a blast. | Fragments after a blast.

STRONGEST and SAFEST EXPLOSIVE Known to the Arts.

POWDER, FUSE, CAPS, Electric Mining Goods,

AND ALL TOOLS FOR STUMP BLASTING, FOR SALE BY THE

HERCULES POWDER COMPANY, 40 Prospect Street, Cleveland, Ohio.

L. W. WILLARD, Manager.

¾ and 11-16 by ⅛ to 3-16 inch	2 25
¾ and 11-16 by Nos. 11 and 12	2 30
⅝ and 9-16 by ⅛ to 3-16 inch	2 40
⅝ and 9-16 by Nos. 11 and 12	2 45
½ by ⅜ to 3-16 inch	2 55
¼ by Nos. 11 and 12	2 60

Wagon Box Iron.

⅞ inch, beveled edge, by Nos. 11 and 12	2 20
⅞ inch, " " " " 13 and 14	2 30
¾ inch, " " " " 11 and 12	2 35
¾ inch, " " " " 13 and 14	2 55

Sheet Iron.

No. 10 to 14	2 30
No. 15 to 17	2 45
No. 18 to 21	2 60
No. 22 to 24	2 70
No. 25 to 26	2 80
No. 27	2 90
No. 28	3 55

Iron Boiler Plates.

Tank, ¼ inch and heavier	2 25
C No. 1, " "	2 40
C H No. 1, " "	2 50
C H Flange, " "	3 50
Extra Flange "	4 00
Solid Fire Box "	4 75

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 25
Shell	2 50
Flange	2 75
Marine Flange	3 00
Fire Box	4 00

Above includes plates 90 inches wide.

90 to 96 in. wide	½c. ℔ extra
96 to 100 in. wide	1 c. "
100 to 104 in. wide	1½c. "
104 to 116 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. ℔s.
1 to 2 in. inclusive	08
9-16 to ½ in. "	08½
7-16 to ⅜ and 2⅜ to 3 in	09
3⅛ to 4 in	09½
⅝ to 11-16 and 4½	10
⅛ to 6 in	10½
¼ to 9-32 and 6⅛ to 7 in	11
3-16 in	13

Flats.

	cts. ℔s.
2 to 9-16 in. wide by 2 to 5⅛ thick	8

Bessemer and O. H. Steel.

Machinery	base price, 2 35
Tire	" 2 25
Spring	" 2 80
Sleigh Shoe	" 2 50
Toe Calk	" 2 35
Cutter Shoes, tapered and bent	" 2 75

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	4 00
Bridge ½, ⅝, 11-16 and ¾ inch diam	4 00

MACHINERY SUPPLY MARKET.

Anvils.

American	℔ 9@10
Wright's	℔ 12

Bellows.

Blacksmiths' Hill's	dis 40
Blacksmiths' Bullock's	dis 50&10
Moulders'	dis 40@40&10
Hand	dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70
" " " extra	dis 60&5
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 45
Shultz Raw Hide Leather Belting, single	dis 40
Munson's Short Lap Single Leather	dis 45
Munson's Short Lap Double and Light Double Leather	dis 50
Shultz Raw Hide Leather Belting, Double and Light Double	dis 40
Standard, oak tanned	dis 50&10
Alexander Brothers' pure oak tanned	dis 45

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.	dis 35
Buffalo	dis 40

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 30
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis 30
Horton's Universal	dis 40
" Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 40
Sweetland "	dis 40
Almond Drill	dis 20
Morse "	dis 15
Skinner's Combination Lathe	dis 40&10
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 35

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15

FRANK R. BIEDLER,

(PRINCIPAL)
Baltimore Offices,
Moore Building,
S. E. Cor. Baltimore and Hanover Sts.

(BRANCH)
New York Offices
Welles Building,
18 Broadway.

MINING, MINERAL AND TIMBER LANDS

Municipal Bonds, Large Tracts of Florida
Farm and City Mortgages, Phosphate and
Short Time Paper. Hammock Lands.

EXAMINATIONS AND REPORTS MADE. Correspondence Solicited.

FOR SALE AT A SACRIFICE

— FOR —

Manufacturing Purposes,

— WITH —

Both CHEAP GAS and CHEAP OIL on the ground as FUEL,

12½ acres of land, with two buildings 90 feet by 240 feet and 60 feet by 140 feet respectively, railroad side track, in

FINDLAY, OHIO.

Address

L. DREIER,

111 Pierrepont Street, BROOKLYN, N. Y.

"THE MESABI RANGE"

AND WINCHELL'S

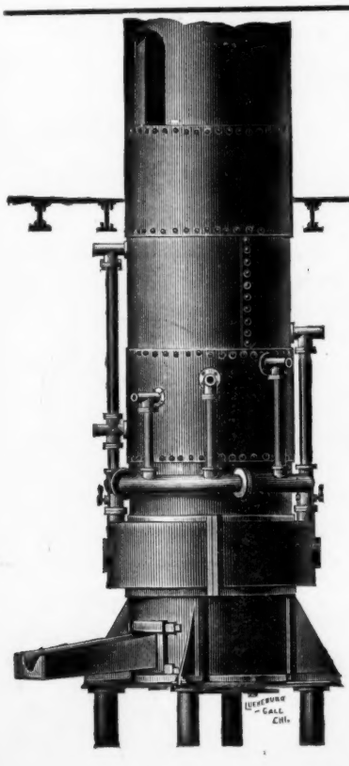
"IRON ORES OF MINNESOTA."

By N. H. WINCHELL and H. V. WINCHELL.

We offer the **two reports, postpaid, for $3.50,** which is the price of "Iron Ores of Minnesota" by itself.

THE IRON TRADE REVIEW CO.,

27 Vincent St., CLEVELAND, O.



THE

GREINER

Patent Economical

CUPOLA.

10 to 50 Per Cent. Saving in Fuel,

With Corresponding Increase in Quality of Iron Melted, Over any Existing Cupola.

15 Per Cent Saving Guaranteed.

Can be Applied to any Type of Cupola Now in Use.

400 IN USE IN EUROPE.
U. S. REFERENCES GIVEN.

AGENTS WANTED.

The Greiner Economical Cupola Co.,

714 Bort Building,
CHICAGO.

Morse.....dis 15
Brown & Sharpe, Milling Cutters.....dis 15
" " Gear Cutters.....dis 15

Crowbars.

Cast Steel.....₩ lb 3½
Iron, steel points.....₩ lb 3½

Drill and Drill Sockets.

Twist Drills.....dis 50&10
Morse Taper and Straight Shank to 1½".dis 50&10
Morse Taper and Straight Shank Larger than 1½".....dis 25
Drill Sockets.....dis 25
Standard Twist Drills.....dis 55@55&5
Cleveland " " .....dis 55@55&5

Emery.

	No. 4 to 46 gr.	No. 54 to 150 gr.	Flour, C. F. F. FF.
Kegs, ₩ lb	4½c	5 c	2½c
½ kegs ₩ lb	4¾c	5¼c	2¾c
¼ kegs ₩ lb	5 c	5½c	3 c
10 lb cans, 10 in case	6 c	6½c	5 c
10 lb cans less than 10	10 c	10 c	7½c

Emery Cloth and Paper.

Barder, Adamson & Co.....dis 50@50&5
H. H. Barton.....dis 50@50&5

Emery Wheels.

Detroit.....dis 55@60
Norton's.....dis 55@60
Grant.....dis 55@60
Sterling.....dis 60
Celluloid.....dis 10&33½
Northampton.....dis 55
Crystal.....dis 65@70
Vitrified.....dis 60
Vulcanite.....dis 60&10
Hamden.....dis 60&10
Cyclone.....dis 60

Files.

Arcade.....dis 60&10@60&10&10
Nicholson.....dis 60&10@60&10&10
" X. F.....dis 25
Kearney & Foot.....dis 60&10@60&10&10
Black Diamond.....dis 60&10@60&10&10
McClellan.....dis 60&10@60&10&10
Disston's.....dis 65@70
Western.....dis 70
Stub's.....dis 25
Grobet's.....dis 30
Reynolds Bros.' Hand Cut.....dis 50
Industry File Works, Hand Cut.....dis 50

Hammers.

P. S. W.....dis 40
Atha new list, Jan. 15, 1887.....dis 50
Heavy hammers and sledges under 5 lbs.....15c
" " " over 5 lbs.....12c

Jack Screws.

Illinois Bolt Co. list.....dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4¼	4	3¼	3½
Hexagon	15½	11½	8½	6	5¾	5¼	5
Washers	9	8	7	5	4½	4½	4½

In lots less than 100 lbs, ₩ lb, add ½c., 1 lb boxes add 1c to list.

Nails (wire).

List July 14, 1887.....dis 75
Standard Penny Nails, ₩ keg card rate
{ Car lots.....$1.50
{ Less than car lots...$1.60

Oilers.

Zinc and Tin.....dis 60
Brass and Copper.....dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz.....dis 10@10&10

Packing, Steam.

Boston Belting Co.....dis 60
American Packing Hemp.....₩ lb 9@10
Russia " " .....₩ lb 14
Italian " " .....₩ lb 13@19
Plumbago Piston.....₩ lb 40
Peerless.....₩ lb 60
Morrison's " .....₩ lb 50
Square Flax " .....₩ lb 50
Sheet Rubber.....₩ lb 12&24
Excelsior Rubber.....₩ lb 48
Rainbow.....{ Full Rolls.....50c ₩ lb; { Less than Full Rolls. 60c ₩ lb
Eclipse Gasket.....₩ lb 75

Picks.

Railroads, 5 to 6 lbs.....$12 dis 60
" 6 to 7 lbs.....$13 dis 60

Pulleys.

Iron Pulleys, Walker List.....dis 40
Medart Pulleys.....dis 50
Split Wood Pulleys.....dis 50@55

Rivets.

Iron, Thousand, list November 17.....dis 50@50&10
Iron, Ordinary, Cooper's Block and Carriage list November 17.....dis 50@50&10
Copper.....dis 50@50&10

Saws.

Disston's Circular.....dis 40&10
" Band.....dis 25
" Scroll.....Net
Hack Saw Stubs.....dis 20
" " Eureka.....dis 20
" " Star.....dis 20
Saw Swages Diston's.....dis 30
Atkins' Circular Saws.....dis 40&45
" Mill, Mulay and Drag Saws.....dis 40&10
" Wood Saws.....dis 40&10
" Silver Steel Diamond Cross-cut Saws.....70c per ft
" Dexter Cross-cuts.....50c "
" Diamond " .....30c "
" Tuttle Tooth Cross-cuts.....25c "
" One-man Cross-cuts.....32c "

No. 1 Handles	23c per pair
No. 6 "	16c "
Excelsior Saw Tools	$6 per doz
Perfection "	$15 "
Detroit Saw Works, Circular	dis 50
" " " Band	dis 25
" " " Mulay	dis 45

Taps.

Cards, Hand and Nut to 2 in	dis 50
Carpenters' " " "	dis 50
Morse " " "	dis 50
Pratt & Whitney " " new list	dis 10
Machine Screw Taps	dis 55
Pipe Taps to 2½ in	dis 70
Stay Bolt Taps	dis 25
Stove Bolt Taps	dis 55
Pulley Taps	dis 40

Vises.

Solid Box	dis 60
Parker's	dis 20@25
Prentiss	dis 20
Stephen's	dis 25@30
Barrett's	dis 30
Miller's Falls	dis 40
Merrill's	dis 15@20
Howard	dis 35

Wire.

New List, Jan. 18, 1884

Brass	dis 30
Copper	dis 40
Bright and annealed, Nos. 0@18	dis 70&10@75
" " Nos. 19@26	dis 75@75& 5
" " Nos. 27@36	dis 75&10& 5
Coppered Nos. 0 to 18, market list	dis 70@70& 5
Galvanized Nos. 0 to 18 " "	dis65& 5
Tinned market Nos. 0 to 18	dis 67½
Cast steel	dis 50
Tinned Broom Wire	dis 70&5@70&10
Annealed Fence, Nos. 8 and 9	dis 75
Annealed Grape, Nos. 10 to 14	dis 75
Stub's Steel Wire regular	95c ℔ lb dis 30

Wrenches.

Coe's genuine	dis 50
Girard Standard	dis 70&10
Agricultural	dis 75&10
Mechanic's	dis 55&10& 5
Bemis & Call's Combination	dis 35
Donohue's Engineers	dis 20&10
Lamson & Sessions Engineers	dis 60
Billings & Spencer's Drop Forged	dis 25
William's " "	dis 25
Alligator " "	dis 40

CLEVELAND BUSINESS DIRECTORY.

Bolt and Nut Works.

THE UPSON NUT CO., Manufacturers of Nuts, Washers, Carriage, Machine, Plow and Elevator Bolts, Coach Screws, etc.

Steel Stamps and Stencils.

FLEHARTY, J. H. & Co., Rubber Stampes Seals, Stencils, Automatic Check Punchs, and Numbering Machines. 92 Seneca St.

GEORGE PEMBERTON,

18 Broadway, - New York.

Mining, Mineral and Timber Lands.

Municipal Bonds, Farm and City Mortgages, Short Time Paper. Large Tracts of Florida Phosphates and Hammock Lands. Investment Securities of all kinds bought and sold on commission.

Correspondence Solicited.

THE S. T. W. EJECTOR.

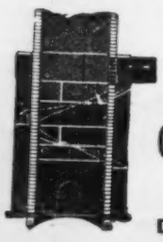
SIMPLEST, BEST and CHEAPEST PUMP made.

SEND FOR CIRCULAR.

James Jenks

199 JEFFERSON AVE.,

Detroit. Mich.



VICTOR COLLIAU,

Sole Manufacturer of the

Improved Patent HOT BLAST

COLLIAU CUPOLA.

ADDRESS:

287 Jefferson Ave.,

DETROIT, MICH.

STEEL, IRON, COPPER, ZINC, BRASS, TIN,

And all Other Metals Perforated as Required for

GRAIN CLEANING AND MINING MACHINERY,
WOOLEN, COTTON, PAPER AND PULP MILLS,
RICE, FLOUR AND COTTON SEED OIL MILLS,
SUGAR AND MALT HOUSES, DISTILLERIES, FILTER PRESSES,
STONE, COAL AND ORE SCREENS,
BRICK AND TILE WORKS, FILTERS,
SPARK ARRESTERS, GAS AND WATER WORKS,
OIL, GAS AND VAPOR STOVES,
COFFEE MACHINERY, ETC., ETC.

STANDARD SIZES PERFORATED TIN AND BRASS ALWAYS IN STOCK.

THE HARRINGTON & KING PERF. CO.,

Main Office and Works, 222 to 240 N. Union St., Chicago, Ill., U. S. A.

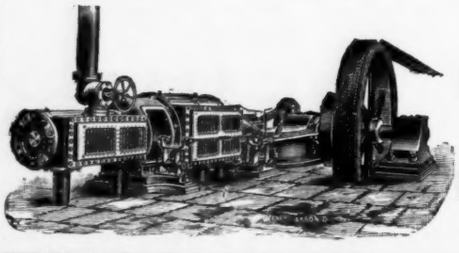
Eastern Office, No. 284 Pearl St., New York.

WILLIAM TOD & CO.

YOUNGSTOWN, OHIO.

THE PORTER-HAMILTON ENGINE

SINGLE, COMPOUND & CONDENSING



Blowing Engines.

Hydraulic Cranes and Accumulators.

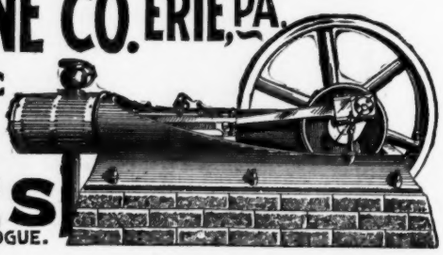
Heavy Special Machinery.

ENGINE CATALOGUE ON APPLICATION.

SKINNER ENGINE CO. ERIE, PA.

Center or Side CRANK Automatic or Throttling

ENGINES



FOR NEW FEATURES SEE NEW CATALOGUE.

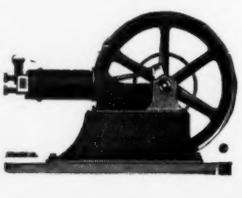
POWER From **GAS OR GASOLINE.**

No Steam, Coal, Ash, Gauges, Engineer nor Danger.

From 1 to 100 horse-power. } Can be Used in City or Country.

In conjuction with our Producer Gas Apparatus, we guarantee coal consumption of 1½ pounds per hour per h.p.

OTTO GAS ENGINE WORKS., 33rd & Walnut Sts. PHILADELPHIA, PA.



GODFREY J. BREMER,

MANUFACTURER OF

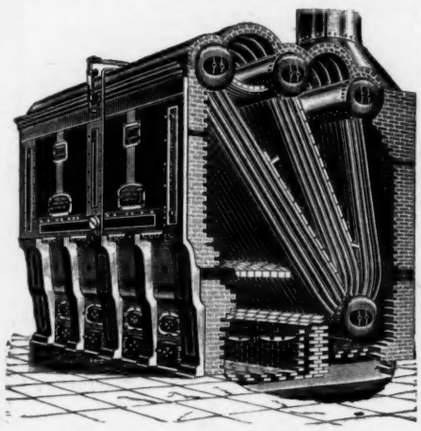
Hand and Power Punching and Shearing Presses, Dies and Special Machinery for Bar and Sheet Metals, Etc., Etc.

Class B. No: 3.

Send for Illustrated Circular.

Mention this paper. **Kalamazoo, Mich.**

THE STIRLING BOILER



Is economical in fuel and repairs, practically self cleaning. Four manholes give access to every tube. It will pay you to investigate before purchasing elsewhere. - - - - -

THE STIRLING CO.,

General Office, Pullman Bldg., Chicago.

CLEVELAND OFFICE, 32 LAKE ST.

Elastic Rotary Blow Riveting Machine.

JOHN ADT & SON,

NEW HAVEN, CONN.

Builders of Machinery for Hardware Manufacture.

AUTOMATIC

Wire Straightening and Cutting Machines,

BUTT MILLING MACHINERY,

Butt Drilling Machinery,

Riveting Machines.

Foot Presses,

Sprue Cutters, Etc.

L. K. COMSTOCK.

Consulting Electrical Engineer,

1419 Monadnock Bldg., CHICAGO.

- - - PLANS. - - -

- - SPECIFICATIONS. - -

- - SUPERVISION. - -

THE AMERICAN Watchman's Time Detector.

This Electrical instrument, which is operated by either battery or magneto generator as preferred, is designed to, and does, keep an exact record of the doings of the Night Watchman in any establishment where it is in use. It is an active and faithful guardian of your premises during the night. It is simple, reliable and absolutely infallible. Cannot be tampered with without certain detection.

Thousands of testimonials from the first concerns in the land. Send for catalogue to

THE CLEVELAND ELECTRICAL M'N'F'G CO.

44 and 46 Sheriff Street, - - - Cleveland, O.

A. B. FOSTER, Treas. and Gen'l Manager.

FOR SALE "BOILERS." (NEW.)

One	45	H. P.	54"	diameter	48—3½"x12"	tubes	Dome	30"x30"
"	50	"	54"	"	48—3½"x14"	"	"	28"x28"
"	40	"	48"	"	44—3"x12"	"	"	26"x26"
"	85	"	62"	"	52—4"x17"	"		No Dome.

FOR SALE (Second-hand Boilers) "A BARGAIN."

8 Boilers, 80 H. P. each, 60" diameter, 16ft. long, 4" tubes, nearly new, "Otis" Steel. Taken out to make room for larger boilers. Fronts and all castings and trimmings.

The Variety Iron Works Co.,

55 SCRANTON AVENUE, - CLEVELAND, OHIO.

THE GLOBE INJECTOR.

Pat. April 19, 1892.

Automatic.

Simple,

Durable,

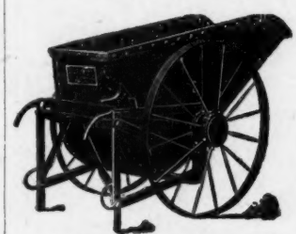
Warranted.

EAGLE LUBRICATOR CO., 106 Canal St., CLEVELAND, O.

- McNEIL'S PATENT -

BALANCED CHARGING BARROW

Automatic Dump. - -



IT HAS NO EQUAL.

—ALSO—

Akron Tubular Steel Wheelbarrows.

ONE MAN CAN HAUL A TON.

Re-enforced Tray. Corners Double Thickness.

THE AKRON TOOL CO., AKRON, O.

Callender & Patterson,

DAYTON, OHIO.

Machinery,

TOOLS AND MANUFACTURERS' SUPPLIES.

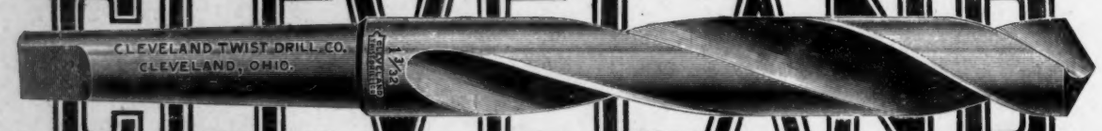
MOULDING SAND, FIRE SAND,

Fire Clay, Fire Brick, Circle Brick for lining cupolas Bristle Brushes, Steel Wire Brushes, Bellows, Riddles, Shovels, Foundry Facings. Foundry Barrows, Pig Iron Barrows.

THE BEST GOODS AT REASONABLE PRICES.

THE J. DOWNERD & SON CO., ZANESVILLE, O.

CLEVELAND



1874—OLD (SEND FOR CATALOGUE. WRITE FOR DISCOUNT.) RELIABLE—1893

THE HART OR DETROIT

Emery Corundum Wheels and Machinery.

Write to J. WENDELL COLE, M. E.,
District Manager, Box 152, Chicago, Ill., or Box 84, Columbus, O.

☞ N. B.—Also Agent for WM. SELLERS & CO.'s SPECIAL TOOL GRINDER and TWIST DRILL GRINDER WITH POINTER, for Pennsylvania, Ohio, Indiana, Illinois and Wisconsin.

PENBERTHY AUTOMATIC INJECTOR

The Simplest,
Most Reliable
Boiler Feeder.

60,000 IN USE.

F-93 **WRITE FOR PRICES, Enclosing this adv.**

PENBERTHY INJECTOR CO., Detroit, Michigan.

E. H. JONES & CO.,

ENGINEERS & CONTRACTORS. 54 Frankfort St., Cleveland, O.

Steam Plant Complete. Engines, Boilers, Pumps, Heaters, Etc.
Steam and Hot Water Heating.

STURTEVANT'S BLOWER, COILS, Etc., for Hot Blast Heating.

Awarded the GRAND PRIZE at the Paris Exhibition.

SEND FOR THIS BOOK
FREE ON APPLICATION.
THE BABCOCK & WILCOX CO
30 CORTLANDT ST. N.Y.
WATER TUBE
STEAM BOILERS
BRANCH OFFICES
BOSTON, MASS. 8 OLIVER ST.
PHILADELPHIA, PA. 32 N. 5TH ST.
PITTSBURGH, PA. 408 LEWIS BLOCK.
CLEVELAND, O. 412 PERRY-PAYNE BG
CHICAGO, ILL. 45 S. JEFFERSON ST.
MINNEAPOLIS, MINN. 604 CORN EX.
NEW ORLEANS, LA. 57 CARONDELET ST.
HAVANA, CUBA. 116½ CALLE DE LA HABANA.
MANUFACTORIES IN UNITED STATES, SCOTLAND, FRANCE, GERMANY & AUSTRIA.

Cleveland Office, 412 Perry-Payne Building, Cleveland, O.

FIRE BRICK. SILICA BRICK.

BRANDS:
J. J.
SAVAGE,
SAND,
CROWN,
AETNA.

J. J. SHEPARD,
MANUFACTURER.
35 to 45 RIVER ST., - CLEVELAND, OHIO.
TILE and SPECIAL SHAPES.

BRANDS:
Shepard,
O,
NO. 1,
Dry Pressed,
W. VA.

FIRE CLAY. FIRE SAND.

NEW IMPROVED
$60 8 and 9 inch Screw-Cutting
Foot and Power Lathes. For weight, proportion, accuracy and trueness, price considered, it excels anything in the market. Catalogue free. Correspondence solicited. Will guarantee all our tools to be as represented. Address
THE SIDNEY MACHINE CO., 217 Main Ave. Sidney, O., U.S.A.

QUINT'S TURRET DRILL,
SIX SPINDLE.

The most durable and sensitive multiple drill made for drilling from 0 to ½ in. All holes drilled in centre of table. Speed of drills from 50 to 2,000 revolutions. Tapping attachment furnished. ☞ Send for circular.

A. P. QUINT, Hartford, Conn.

SHEPARD'S NEW $60
SCREW CUTTING
Foot Lathe

Cap Lathes, $1.25.

Foot & Power Lathes Drill Presses, Scroll Saw Attachm'ts, Mandrels, Chucks, Twist Drills, Dogs, Calipers, etc. Lathes on trial, Lathes on payment. Send for catalogue of Outfits for Amateurs or Artisans. Address **H. L. SHEPARD, Agt.,**
124 East Second St., CINCINNATI, O.

INDUSTRY FILE WORKS,
A. & H. GOUGH, Props.,
Manufacturers of
Files & Rasps,
Equal to the Best English File.
OLD FILES RE-CUT.
ALL KINDS OF JOB GRINDING.
OFFICE & WORKS,
48 COLUMBUS ST.,
CLEVELAND, - O,
C. GOUGH, Manager.
Mention this paper.

Bischoff Metal Ceilings,
(PATENTED.)

It will pay to investigate and write for catalogue.

Estimates submitted on application.

Fred. F. Bischoff & Co.
24 W. Lake St.,
CHICAGO, - ILL.